SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI.--No. 12.] [NEW SERIES.] NEW YORK, MARCH 24, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

PNEUMATIC TRANSMISSION.

FROM "ELECTRICITY AND THE ELECTRIC TELEGRAPH," BY GEORGE B. PRESCOTT.

The transmission of messages between the branch and central stations in the large cities, by means of pneumatic tubes, constitutes an important and valuable feature of the modern telegraphic establishment.

Messages are sent from the Central office of the Western Union Telegraph Company, New York city, by compressed air, and to the Central office by exhaust air, the engine, pumps, and valves being at the Central office. In our large illustration, Fig. 1, is represented the receiving and sending station in the operating room of the above named company's building. The tubes on the right are those in which messages are dispatched; from those on the left messages are received. The mode in which the missives are prepared for transmission is described in detail further on. It will suffice to say here that the paper is folded and inserted in a felt-covered case. A valve is opened and the latter inserted in the lower end of one of the tubes. The valve is then shut, and in thirty-two seconds the case travels through about 2,100 feet of tube and arrives at the Broad street station, the fact being announced by the sounding of an electric bell at the sender's table. To make the journey through the 3,308 feet of tube, between the Central office and the Cotton Exchange, occupies about 55 seconds: the compressed air which empties the case being under a pressure of about 9 lbs. Although by using greater pressures a higher velocity is easily attainable, the above is found to answer practical requirements best. To draw cases from the stations to the Central office a vacuum of some 12 inches is employed. The number of messages transmitted daily between the hours of 8 A.M. and 5:30 P.M. averages, we are informed, from two to three thousand. The arrangement of the apparatus is as follows: To the pumps are attached two large mains, one for pressure and the other for vacuum. These mains are carried from the engine room to the operating room, where the pneumatic tubes are situated, and are of such dimensions as to obviate the effect of the intermittent action of the air pumps. The valves are of two kinds, single and double sluice, and are so arranged that they can be employed for exclusively forwarding messages by compressed air, exclusively receiving messages by exhausting air, and for alternate forwarding and receiving through a single tube. The arrangement of the single sluice valves is shown in Figs. 2 and 3, on page 178. T is the tube which forms the prolongation of the underground conductor.

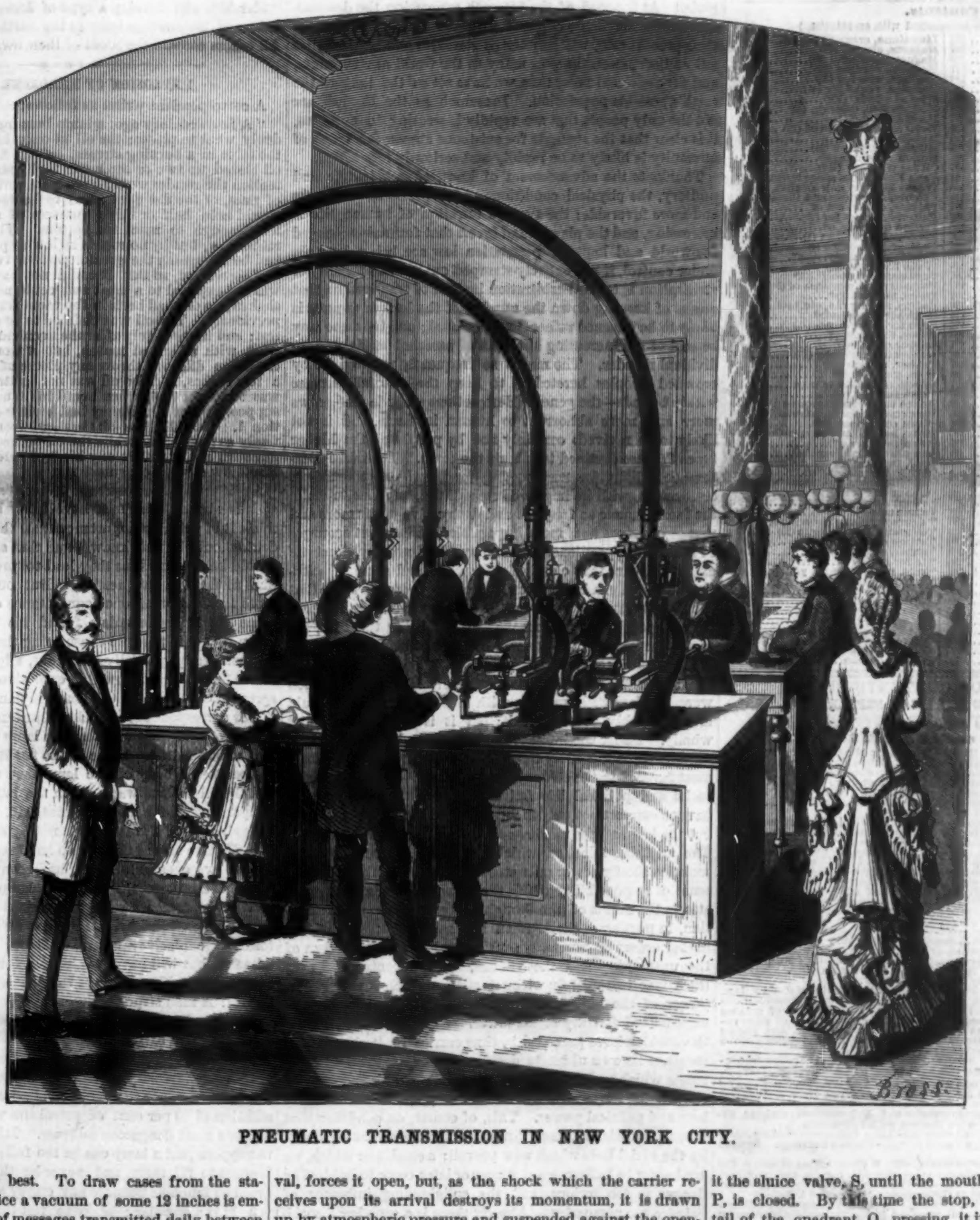
To receive a carrier at the Central office the lower end of this tube is closed by raising the hinge valve, C (which has a rubber packing); the stopcock, V, is then turned, which establishes a communication, through T and S, with the vacuum main. A vacuum is produced in T, and the valve is kept closed by atmospheric pressure. The carrier, on arrival, forces it open, but, as the shock which the carrier receives upon its arrival destroys its momentum, it is drawn up by atmospheric pressure and suspended against the opening, O, of tube, S. As soon as valve, C, falls, the operator shuts the stopcock, V, and the carrier, being no longer held by the outside pressure, falls out of the tube, T, by its own weight. To send a carrier from the Central office, it is placed in the tube, T, Fig. 3, and the operator, by means of the handle bar, *m*, pulls the sliding apparatus, formed by the rods, *g*, and the crossbar, *d*, which latter meets the ring, *b*, fixed on the rod, *f*, and carries this with it. The obturator, K, fixed to the end of *f*, is thus made to close the extremity of the tube, T. When this closure is complete, the inclined plane, *h*, fixed on one of the rods, *g*, meets and pushes back the roller, *j*, thus opening a valve within the cylinder, L, and establishing communication between the reservoir of compressed air and the tubes, M and T. The carrier is there forced forward in the tube, and whenever its arrival is announced by the electric bell, the slide is pushed back to its normal position.

If the rod, *f*, were connected rigidly with the crossbar, *d*, a certain effort would be required to push back the slider, owing to the friction due to the pressure on the surface of the obturator. This effect is avoided by making the rod, *f*, slide in the crossbar between the limits, *b* and *l*, for, in pushing it back, the inclined plane first leaves the roller, *j*, and the compressed air ceases to enter the tube; then the crossbar meets the ring, *l*, and the rod, *f*, removes the obturator without difficulty.

The greater portion of the parts which form the valves are made of brass. They are attached to strong boards, the one in a vertical and the other in a horizontal position. The latter forms the table, and receives the carriers to be sent, and those which are received from the corresponding offices.

The accompanying diagrams show, Fig. 4 a back view, Fig. 5 a section, and Fig. 6 a top view of the double sluice pneumatic valve. The following is a description of the method of using it and of its action: To send a carrier by the forwarding or outward tube, the mode of working is as follows: The carrier containing the message is inserted up the mouth of the pneumatic valve, P, Fig. 5, into the message chamber, M, until its buffer is held by the contraction at C, which is the true diameter of the message tube. (The illustrations show the valve in its normal position.) The handle, H, is then drawn forward, carrying with it the sluice valve, S, until the mouth of the message pipe, P, is closed. By this time the stop, S', strikes against the tail of the quadrant, Q, pressing it into the slot, *s*, of the steel slide bar, B; and by the continuation of the motion necessary to bring the sluice valve, S, to the end of the sluice box, *b*, bringing with it the tail of the quadrant, which is centered at O, gives an opposite motion to its other extremity, which, fitting into the rack, R, opens the top sluice, T. During this motion an inclined plane, I, Fig. 6, which is fixed upon one of the side rods carrying the lower sluice, passes between the fixed roller, F, and the roller fitted upon the pressure valve, V, establishing communication between the pressure main and the message pipe; the air thus admit-

[*Continued on page* 178.]



PNEUMATIC TRANSMISSION IN NEW YORK CITY.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.............................. $3 20

One copy, six months, postage included.............................. 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars.* Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

VOL. XXXVI., No. 12. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, MARCH 24, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 64,

For the Week ending March 24, 1877.

SELECTION APPLIED TO MAN.

The population of our globe is now about fifteen hundred millions, or about an average of thirty to the square mile of land surface. With proper cultivation of both land and water, and the largest possible reclamation of waste and desert land by irrigation and otherwise, the earth is capable of supporting perhaps ten times as many people: probably not more, as that would require every inch of dry land to be as densely populated as China now is, and a very considerable portion of the earth's land surface is and must ever remain practically uninhabitable.

Assuming such an increase of the world's population to be possible, the question naturally arises: When is the limit likely to be reached—and what then? The contingency may seem at first sight to be very remote, but in reality it is not, provided human progress continues at the present rate. The dominant race of to-day is that which is fairly represented by the people of England. The influences of modern civilization have been felt on that island as manifestly as anywhere; and we shall not go far wrong if we estimate the progress of the immediate future by the ratio of the immediate past. The population of England at the beginning of the present century was, in round numbers, a little under 9,000,000. It is now not far from 24,000,000. With the same rate of increase for seven generations more, the English people will equal in number the present population of the entire globe! At the end of the fifteenth generation the descendants of the English people, if they continue to increase at their present rate, will number (if statistics and mathematics tell no lies) fifteen times as many as the world now supports, and fifty per cent more than we have set as the limit of the earth's possible population. Inasmuch as the English are not the only people that are rapidly increasing in numbers, it is clear that the struggle for existence among the tribes of humanity is likely to be rapidly and seriously intensified.

Thanks to the advancement of knowledge, scientific and sanitary, the physical conditions of life are becoming more and more favorable; the average duration of human life is increasing, and the plagues and fevers that formerly scourged the world and kept the population low are being brought under control, if not entirely stamped out. The tendency of civilization is toward arbitration instead of war, and so that means of keeping down the number of the human swarms is likely to be lessened rather than increased; and the same may be said of the increasing abolition of personal strife and individual murder. The means so frequently resorted to by crowded peoples heretofore to keep the natural increase within bounds—the general destructions of infants—grows more and more abhorrent to human instincts, and is not likely to be revived: certainly not by people of the higher types that are destined to inherit the earth. The multiplication of facilities for transporting food, incident to modern civilization, with its improved agriculture, combine to make the famines once so frequent and destructive of life more and more rare, more and more impossible. The great scourges of humanity—pestilence, famine, war, and murder, domestic and social—are thus clearly on the wane; and as no substitution for them can be foreseen, there is no reason to infer that the present rapid increase in the earth's population is likely to be stayed by natural means. Such being the case, the earth's sustaining capacity will be reached before the race is many centuries older.

What then? Will the fittest survive? If natural selection were the law with man as with brute nature, that would most probably be the result; but it is not. That is, not wholly. Under the influence of charity and other religious sentiments, it is usually the weakest, often the worst, that is most favored in the struggle for existence. The burdens of social and political life fall chiefly upon the worthy, who have to support not only themselves and their own offspring, but the idle and the vicious and their multitudinous spawn. The artificial selection which religions, governments, and societies chiefly foster tells steadily against the best. The sense of responsibility which the struggle for existence creates in the minds of the thoughtful tends in the same direction, in putting a check upon the natural increase of the higher orders of humanity; while the heedless animalism of the unthinking and the vicious, on the contrary, leaves them free to multiply without stint, and the superior life-power of the higher is no match in the long run for the unrestricted fertility of the lower. Our civilization, like all those which have preceded it, thus carries in itself the elements of its own ultimate destruction: or, at the least, elements which make its overthrow possible at any moment, by causing the lower grades of culture to preponderate in numbers and political power. This, of course, on condition that human societies continue through future ages to be regulated by the social laws which now prevail: a condition which, we are happy to believe, must sooner or later cease to hold. The danger is too serious, and the enlightening influence of Science too persuasive. Already there is a growing disposition on the part of intelligent lovers of humanity to break away from the unscientific customs that have come down to us from barbaric ancestors; and the instinct of race-preservation will compel a radical change in many of them, particularly those which determine our treatment of the physically and morally tainted. Preventive measures are rising more and more above those that are palliative and remediable; charity is becoming broader and more far seeing; the rights of future generations begin to weigh against the privileges of the present; and there is infinite promise of good in the change.

It would be sheer presumption and foolishness to predict specifically the issues of conditions so complicated as those of existing humanity; but having in view the intensifying struggle for existence in store for future generations, and knowing the immense advantage which a pure and high race must always have over lower races, it is safe enough to predict that the ultimate dominion of the world will rest with that people, whether black, yellow, or white, which will so shape its political and social system as to rigidly favor the perpetuation of its best—which will studiously eliminate every serious moral or physical taint from its life-stem. As *all* cannot survive, it is becoming more and more the duty of humanity to elect wisely *which* shall survive, the good or the bad: or more correctly, perhaps, whether the chances of any unborn generation are in favor of physical and moral health, or the contrary. To favor the former does not imply or necessitate the destruction of any life; but it does necessitate such an interference with individual liberty as shall restrain the vicious and the diseased from being over-represented in generations to be; and the time may come when it will be vitally necessary to prevent such debasing elements from being represented at all. At any rate, it is clear that, whatever high-grade people first rises to the moral level of applying a proper system of artificial selection to humanity, and steadily purifies its stock by eliminating vitiating strains, criminal or otherwise, that people will lead the world in civilization and power. It will do more: it will retain that leadership, and develop a type of humanity which will endure and improve as long as the earth remains habitable. All others contain the seeds of their own destruction.

EXPLOSION OF KEROSENE LAMPS.

A correspondent writes as follows:

"A few evenings ago, a lamp burning in my kitchen suddenly went to pieces; the oil at once blazed up and ran off the table in a burning stream, setting fire to the floor. The oil blazed up two or three feet high, and but for prompt attention the results would have been serious. The lamp was of glass, of the flat form, said to be the best; the oil vessel would hold half or three quarters of a pint; the wick was long enough to reach the bottom. The flame was turned rather low, but by no means as low as possible, and the lamp had been burning the greater part of two evenings since it had been filled, so that it could not have been too full. It was not exposed to a draft and could not have been upset or shaken; no one had been in the room for at least half an hour previously. The oil was claimed to be able to stand 150° fire test; and immediately after the accident some of the oil was tried with a lighted match, but it would not burn. The explosion did not throw any pieces of the lamp more than a few inches, and the oil was not scattered at all; the noise was so slight that, when heard in an adjoining room, it was supposed that the chimney had broken and fallen off. Question 1. Why did the oil that ran from the lamp burn as freely as turpentine, while the oil poured from the can would not burn at all? 2. Is any kind of kerosene oil safe, and (3) if so, how can the consumer test it?"

As this subject involves the protection of life and property, and as similar instances have lately become common, we think it of primary importance that the causes of such accidents should be well known, and that some prevailing errors should be corrected, as they lead to precisely such catastrophes as the one in question. But our correspondent was more fortunate than one acquaintance of ours, who, coming home late in the evening, found his house entirely burnt down, the only possible cause being that a servant had left a kerosene lamp, partially burnt out, alight in her room, and as the flame burned down an explosion doubtless followed, spread the oil, and set the house in flames.

Our correspondent's accident illustrates the following popular errors: 1. He states that the lamp was of the flat kind, said to be the best. Some of the flat lamps have the flame so near to the body of the lamp that the containing vessel and the oil become warm; then the latter easily reaches the temperature of the flashing point, 110, 120, or more degrees. This shows that flat lamps are not by any means the safest.

2. He also says: "The lamp had been burning the greater part of two evenings since it had been filled, and so could not have been too full." A full lamp cannot explode; explosion is caused by the space in the lamp over the oil, which, when filled with air mixed with vapor of the oil, forms an explosive mixture. A barrel full of petroleum can take fire, but will never explode. Not long ago, we had an illustration in New York of the dangers of empty petroleum barrels: A man struck a match, in order to light a pipe, upon an old petroleum barrel, and it exploded at once, nearly killing him. The barrel was filled with a mixture of petroleum vapor and atmospheric air, which happened to be in the proportion necessary to make an explosive mixture, namely, 1 volume of vapor to about 10 volumes of air. In fact, the addition of 10 per cent of petroleum vapor to common air makes a most dangerous mixture. It is, therefore, an error to suppose that a lamp can be too full; and we advise housekeepers to fill them, and never let them burn out, and to avoid as much as possible any empty space over the oil.

3. It is a popular mistake to test the oil at the common temperature. Only benzine and naphtha will take fire under these circumstances; but if the kerosene is adulterated with the latter, the mixture may be ignited also. Good kerosene, when cold, will burn only with a wick; but if we warm it, the vapor will first flash on nearing a flame; if we warm it more, the oil itself will take fire.

We should, therefore, warm the oil when we test it: the simplest way is to pour some in a tablespoon and keep it in contact with the surface of hot water, of which the temperature can be found with a common thermometer; if the oil is claimed to stand the fire test of 150°, it ought not to burn before being heated to that degree. We published an illustra-

tion of a simple method of testing kerosene on page 402 of our volume XXXIV.

It will thus be seen that our correspondent's lamp exploded because it had burned for a long time since filled, leaving a space over the oil, which filled with its vapor as the lamp, being of the flat kind, became warm. When the flame was turned down, the lamp cooled a little, the vapor contracted, and in its contraction drew in air, until enough of it had entered the space above the oil to form the explosive mixture above referred to. This mixture was set on fire by the flame; and, of course, the lamp was broken by the explosion. The kerosene left in the flat lamp became heated by the flame, being much nearer to it than it would have been in a lamp of a taller or more nearly globular form, and of course was therefore ready to burn, while the cool kerosene in the can was not. The pieces of glass were not scattered much and the explosion made little noise, because either there was not a very large space filled with the explosive mixture, or the explosion took place as soon as the mixture became inflammable, and before enough air had been drawn in to give the mixture the most effective proportion.

We believe that these remarks solve the difficulties which many readers have encountered; and we will close this article with a few words of advice. 1. Do not buy lamps in which the flame is too near the body of the lamp. Kerosene can ascend in a long wick; and short wicks only tend to heat lamps and oil, and to encourage accidents. 2. Use the cylindrical wicks, with the draught in the middle; and use a long burner, which brings the flame to a distance of at least three inches from the body of the lamp. The form of the brass student's lamp is a very safe one, as in this the oil reservoir is at a long distance from the flame. 3. Be always prepared to test the oil you buy, as already described. You can heat the water to boiling point, and then mix it with cold water until it shows 150°, or any other desired temperature. If people would take the trouble to apply this simple test occasionally, they would largely diminish the number of accidents. 4. Keep the lamp full of oil, and never let the kerosene burn away much, and so avoid the dangerous empty space above the oil, especially when the lamp is flat and the flame not far above it. 5. Never turn a kerosene lamp low; rather extinguish it, as, besides the possible danger already described, there is the nuisance of an unpleasant and unwholesome smell given off when the wick is turned lower than it is intended to be used. The cause of this is imperfect combustion, and the consequent evolution of injurious gases.

A LESSON IN ARCTIC NAVIGATION.

For a number of years an enterprising Canadian, Mr. E. W. Sewell, of Levis, has maintained the possibility of safely and profitably navigating the ice-bound waters of the St. Lawrence river and gulf in winter, thus practically overcoming the hitherto unbroken blockade of Canadian ports during half of each year. After long and strenuous efforts, he succeeded last year in persuading the Dominion Parliament to subsidize a line of mail steamers for winter service, and proceeded to build and equip a vessel for the arduous work. The steamer was completed, and her first trip successfully made about the middle of January, between Pictou, Nova Scotia, and Georgetown, Prince Edward's Island, a distance of about fifty miles.

The "Northern Light," as the pioneer navigator of Canadian ice floes has been named, is a small but powerful propeller of 400 tons register, 145 feet in length, and 25 feet beam. She is driven by a pair of compound engines of 700 horse power, and is immensely strong, her horse power per foot of displacement being greater, it is said, than that of any other vessel of the kind. Her screw is twelve feet in diameter, 19½ feet pitch, and well submerged, it being intended, as a protection against ice, that at least four feet of water shall in all cases cover the upper blades. Her draught varies from eight forward to sixteen feet aft, to enable her to ride upon and break down the ice floes as well as crush them by her momentum. Very little iron was used in her construction, except a plating 4½ inches thick for fourteen feet abaft her stern, a 2½ inch plating on her keel for part of its length, and a massive rudder of solid wrought iron. The rest is sheathed with 2½ inches of ironwood.

The first trip of the Northern Light demonstrated her ability to overcome the heavy ice floes of Northumberland Strait, and to make good progress through continuous fields of unbroken ice nearly a foot thick. The only accident occurred in a narrow channel near Pictou Island, crowded with heavy floes: in charging an unusually heavy mass of ice the iron cutwater was torn from its bolts by the shock, but no other damage was done. A correspondent of the *Tribune* reports the incidents of the first trip at considerable length, and is naturally exultant at her success:

"We had done what no man has done before. We had sailed in midwinter across the Strait of Northumberland, and shown that with proper appliances men may defy the ice blockade which for nearly two centuries has shut out Prince Edward's Island from traffic with the outer world. And if the narrow strait can be crossed, it follows that the wider waters of the Gulf can be more easily penetrated to ports like Gaspé, Richibucto, and Miramichi. With these connected with Halifax, Cape Breton, or Newfoundland, by a line of powerful ironclad steamers, the present water isolation of Canada will be exchanged for an uninterrupted and profitable, although limited, winter commerce. Who can say that Louisburg's deserted harbor, or Placentia's squalid haven, may not yet become of renewed importance as the depot of the winter exports of the Dominion?"

Mr. Sewell's scheme involves the winter navigation of the St. Lawrence river, below Quebec, as well as the Gulf: the beginning being made in Northumberland Strait, not because its navigation is easier than elsewhere, for that route is really the most difficult of all, but because of an agreement made when Prince Edward's Island joined the Canadian Confederacy, that strenuous efforts should be made for the winter navigation of that channel.

LIGHT AND THE DISTANCES OF THE STARS.

A correspondent writes as follows:

"One of the New York daily papers gives an account of a recent lecture delivered by a Professor Grant on astronomy, in Great Britain, and reports him to have said that some stars are so distant from the earth that light, traveling at the rate of 185,000 miles a second, would take half a million of years to reach us, and that consequently we would observe now what had transpired on such stars half a million years ago. Is not this last statement entirely erroneous? Does not the eye travel almost instantaneously along the line of direction of any object within the range of either unassisted human or telescopic vision, and do we not accordingly see what is transpiring now at any point within such range? Please state whether this view or that imputed to Professor Grant is correct."

To point out the error in our correspondent's reasoning, we have only to apply it to the propagation of sound and to the ear: and then we may ask, almost in the same words: "Does not the ear travel almost instantaneously along the line of direction of any sounding object within the range of either unassisted or assisted human hearing, and do we not accordingly hear what is transpiring now at any given point within such range?" We may ask this with good reason, because the natures of the propagation of light and sound are identical, the eye being the organ for the perception of the first, the ear that for the perception of the second. Now the fact is that the eye (or the sight) travels as little toward the luminous object as the ear (or the hearing) travels toward the sounding object; both organs merely receive impressions from the luminous or sonorous rays. It is perfectly well established that we see astronomical events later than they occur, and it was this fact which taught us that light moves with a velocity of 185,000 miles per second. The eclipses of the moons of Jupiter revealed to Roemer, the celebrated German astronomer, this fact; he found an irregularity which no astronomical data could account for, and he observed that the periods between these eclipses were longer when the distance between us and the planet was increasing, while, inversely, the periods became shorter when this distance was diminishing. He found at last, by close observation, that every time that the planet was, say 100,000,000 miles further off, we see that eclipses happen 9 minutes later then they do when the planet is at its nearest distance. As 9 minutes is 540 seconds, we have only to divide 540 into 100,000,000 to find the velocity of light per second, which is very nearly 185,000 miles. This has been verified afterward in various other ways; the velocity of light has been directly measured (by the help of most ingenious and delicate apparatus) by Foucault and Fresnel; while the aberration of the fixed stars, which consists in an apparent displacement of the same, produced by the yearly motion of the earth in its orbit, fully corroborates the scientific theory. It is, therefore, a positive fact that we see the stars as they were at the time when the light which reaches us now left them; and we see the sun as he was 8 minutes ago, the nearest fixed star as it was 3½ years ago, and the pole star as it was 36 years ago. Of the other stars, very few are near enough for us to measure their distances; but most of them are thousands of times further off, and therefore we see them as they were thousands of years ago; and when the telescope reveals, in the depths of infinite space, stars thousands of thousand times further off still, we are convinced that, as their light can only reach us in millions of years, we see them as they were millions of years ago. Perhaps at that remote period, in those unfathomable distances, blazing suns have been created of which the light has not yet reached us, and inversely those may have become extinct of which the light reaches us now: in the same way as when the sound of a gun, exploding at a great distance, reaches us, the real explosion is a thing of the past, and may have taken place 50, 60, or more seconds before, according to the distance.

THE NEW ENGLISH PATENT BILL.

For the third time, a bill providing for material alterations in the English patent system has been brought before Parliament. In 1875 and 1876, one was introduced by the Lord Chancellor in the House of Lords; at present the bill is under the sponsorship of the Attorney General, and makes its appearance in the House of Commons. The chief feature of the new law is the abolition of the present system of granting protection, and substituting therefor a system of examination similar to that practised in the United States. That gigantic appendage of wax, with its elaborate attachment and tin box, known as the Great Seal, is to disappear; and in lieu thereof the patent will be sealed with a simple stamp. The lifetime of a patent is to be twenty-one years; but unless the patentee obtains a certificate of renewal before the end of the third, seventh, and twelfth years respectively, the patent will cease at the end of any one of these periods.

One good thing at least is proposed in this bill, and that is the reduction of the expense of an application to one half the present cost. The scale of taxes is to remain the same as under the previous law: namely, before the end of three years, $250; before the expiration of seven years, $500; with a further $500 before the end of twelve years, thus extending the full term of a patent to twenty-one years, being seven years more than are now allowed for the full term of a patent. The Lord Chancellor is empowered, under the new bill, to grant a longer time for the payment of these taxes in cases where patents have been accidentally allowed to lapse.

Among the other more important provisions is one giving the Crown unlimited powers to use any invention at a price to be decided by agreement of the parties; or where there is no agreement, the "Treasury or some other tribunal" is charged with arbitration. The objectionable feature of compulsory licensing is introduced in one clause, and in another patentee risks the revocation of his patent if within the three years he fails to use or put the invention in practice in Great Britain. If the patentee does not see fit to grant licenses, the Lord Chancellor has the right to do so. This is an interference with the right of every man to his own property, for which it is difficult to see any justification. Lastly, the old system of granting patents to the importers of foreign inventions is to be abolished; but the bill does not propose to prevent foreign inventors from securing patents on the same conditions as British subjects, provided the inventions have not been patented abroad or introduced into the realm for more than six months. The granting of amended or supplementary patents—similar to the French *brevets d'addition*—is provided for.

The above are the outlines of the bill which is now under discussion, and of which the British Government are using every endeavor to secure the passage. Our English contemporaries, in very lengthy discussions of the subject, think that, before it becomes law, several of its provisions will meet with material modification.

In the early days of our Patent Office, say from 1836 to 1850, but few applications for patents were made in a year, and as a consequence the range of cases available to the examiner for purposes of reference was obviously much smaller than it is now. But since the aggregate of American patents has reached nearly 200,000, while thousands have been granted abroad—for nearly every country on the globe now has its patent laws—it has manifestly become impossible for thorough searches to be made, and hence it is almost useless to employ an examining force to decide whether or not a patent should be granted. After thirty years' experience in soliciting patents, not only in this country but all over the world, we think we have had superior opportunities for observing the working of the various patent systems: and as a result, our opinion is that the existing English system of issuing patents presents the fewest objectionable features. To abandon that system in favor of a plan of official examination, similar to the necessarily imperfect one which exists in this country, would be a blunder.

The London *Engineer*, reviewing the new bill, says:

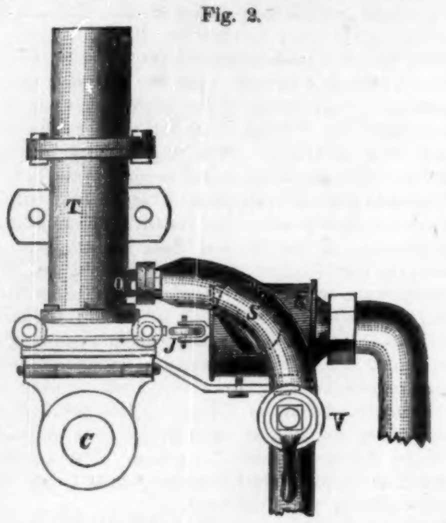
"It is somewhat unfortunate that the existence of the system in the United States should be cited as an argument in favor of its adoption here, because it is a matter of common notoriety among those who have taken the trouble to inquire that the fact of a preliminary examination being required is in truth not an obstacle to the re-patenting of old inventions; and the further fact, which we have already pointed out, that during the years 1872, 1873, and 1874, from 212 patent actions reported in the United States, there resulted the destruction of no less than fifty-three patents on the ground of want of novelty, is very significant. Moreover, the American technical press has constantly complained of the serious defects of the system followed by their Patent Office, a system which, it should be borne in mind, has been in process of elaboration ever since the year 1836, a period which may be regarded as almost coincident with the history of invention in that country. There is, however, to our mind, a vital objection to any system of preliminary examination. It is an objection which no refinement of practice can remove, because nothing short of infallible wisdom or omniscience in the examiners would neutralize it. We allude to the possibility of the destruction of an invention almost in its inception, in consequence of the difficulty or impossibility of inducing an examiner, or the Court, to perceive in it the one, perhaps delicate, distinction between it and something that has gone before—a distinction which may be the means of building a great success upon the ruins of many previous failures. This is not a novel objection, but it cannot be too strongly urged. To take an example: In his able paper on the expediency of a patent law, Mr. Bramwell alluded to Watt's invention of the separate condenser. If we imagine to ourselves a reference of Watt's application to an examiner, fully informed for the period at which the invention was made, is it not more than conceivable that the examiner would have pronounced against Watt on the score of novelty? His engine resembled other engines, but he separated his condenser from his cylinder, a change which in all probability the examiner would have said was a mere detail introduced for the purpose of setting up a claim to invention. Again, we have a still more striking illustration in the case of the regenerative furnace, a patent for which was refused to Mr. Siemens* simply because, in an old house belonging to an order of mediæval knights, it had been found that the hall was warmed by means of air drawn through heated stones. The actual apparatus, we believe, consisted of two chambers under the floor filled with stones. Each was alternately heated by a furnace and alternately cooled by a current of air, which, after it had abstracted heat from the stones, was turned into the building. No other such apparatus had been known to exist, but the authorities found it out and judged Mr. Siemens' stove to be an old invention. Fortunately, the doors of the English Patent Office were open to him, and we know the result. How often do we find that the novelty of an invention is only determinable after prolonged and costly litigation—litigation which is generally in proportion to the value of the patent? It should be remembered that the law is satisfied with the barest amount of novelty; and if that little is often so difficult to discover, it is fair to ask what the examiners will do for us, and what estimate we may make of the costs of an elaborate argument on appeal from them."

* The rejection of Dr. Siemens' application here referred to was made, we believe, by Prussia, which is almost the only country besides our own which maintains an examining bureau to decide on the novelty and utility of inventions.

[*Continued from first page.*]

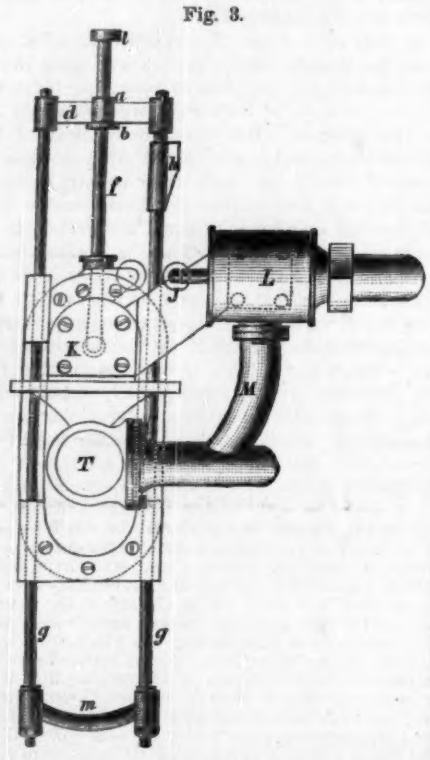
ted immediately acts upon the lower part of the carrier (which portion it expands, so as to make it fit the pipe with

Fig. 2.



as little friction as possible) and forces it onward to its destination. If it be necessary to send a second carrier while the first is in transit (a process which is undesirable), the

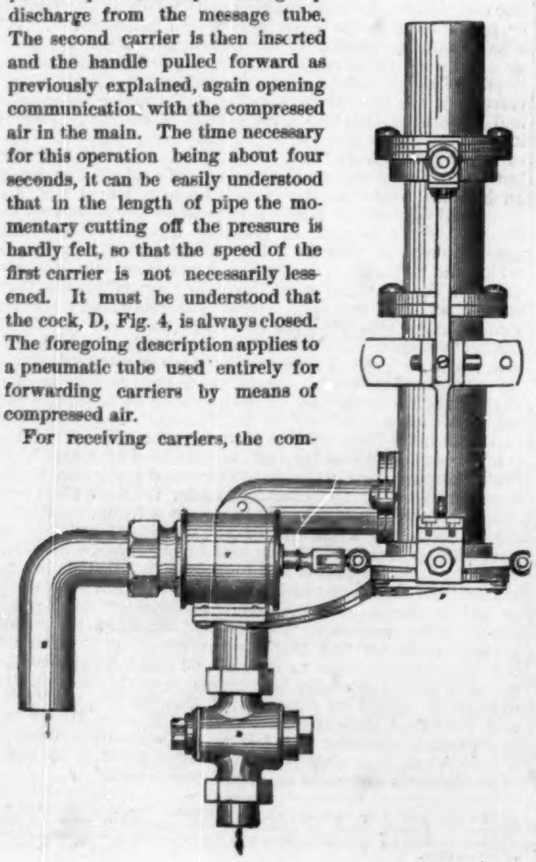
Fig. 3.



handle, H, Fig. 5, is pushed back to its normal position, thus producing a reverse motion of the valves by closing the upper part of the tube before the lower part is opened, and preventing any discharge from the message tube. The second carrier is then inserted and the handle pulled forward as previously explained, again opening communication with the compressed air in the main. The time necessary for this operation being about four seconds, it can be easily understood that in the length of pipe the momentary cutting off the pressure is hardly felt, so that the speed of the first carrier is not necessarily lessened. It must be understood that the cock, D, Fig. 4, is always closed. The foregoing description applies to a pneumatic tube used entirely for forwarding carriers by means of compressed air.

For receiving carriers, the communication between the pressure main and the pressure valve, V, is first cut off by means of a stopcock fitted upon the tube, E, but lower than is shown in the diagram. The handle, H, is then drawn forward, and the stopcock, D, opened, thereby establishing communication between the message pipe and the vacuum main. The carrier inserted at the distant end is then pushed forward by atmospheric pressure, until it arrives in the message box, M, and signals its arrival by the sharp noise caused by its striking the sluice valve, S. The handle, H, is then pushed back, the stopcock, D, having been previously closed; and, by the arrangement already described, the message pipe is closed by means of the sluice valve, T, Fig. 4, and the bottom of the tube being open the carrier falls out of the message chamber, M. It will be remembered that before the admission of compressed air the forwarded carriers are held at C. The buffers of the received carriers, however, having passed this point, the carriers rest free in the chamber, M, and drop out.

Fig. 4.



When the tube is used for a constant succession of carriers from the out station, it is necessary to pull forward the handle, H, immediately after the taking out of any carrier. The short space of time occupied in this operation will not have any appreciable effect upon lessening the speed of the succeeding carrier. It will be seen, therefore, that a number of carriers may be continuously passing in succession through the tube. It is, however, undesirable to permit more than one carrier to be in transit at the same time. Where the traffic is not sufficient to warrant the expense of an up and down tube, one tube only is worked in both directions in the following manner: The top sluice, T, is entirely thrown out of use. This is done by removing the plug, G. The rack, R, is then removed, and the sluice valve, T, drawn back, and held in that position by a small clamp made for the purpose. The tube is then in its normal state for alternate traffic, and entirely open to the atmosphere.

To forward a carrier, it is inserted in the message chamber as previously described, and the handle, H, drawn forward. The sluice valve, S, first closes the orifice, P, after which the continuation of the motion opens the pressure valve, by means of the inclined plane on the slide rod, and the carrier is forced to its destination. The handle, H, is, immediately on the arrival of the carrier being signalled, pushed back sufficiently far to remove the inclined plane from between the rollers, so as to close communication between the message pipe and the pressure main, but not far enough to remove the sluice valve from over the mouth of the message chamber By this means the compressed air which remains in the pipe expands to the atmospheric pressure through the distant end of the pipe only. To receive a carrier, the cock, D, Fig. 5, is opened, and a communication is thus established between the vacuum main and the message pipe. The carrier is pushed forward from the distant end, as in the case of the continuous working, and signals its arrival by striking the sluice. The vacuum is then cut off by closing the cock, D. On pushing back the handle the carrier falls out.

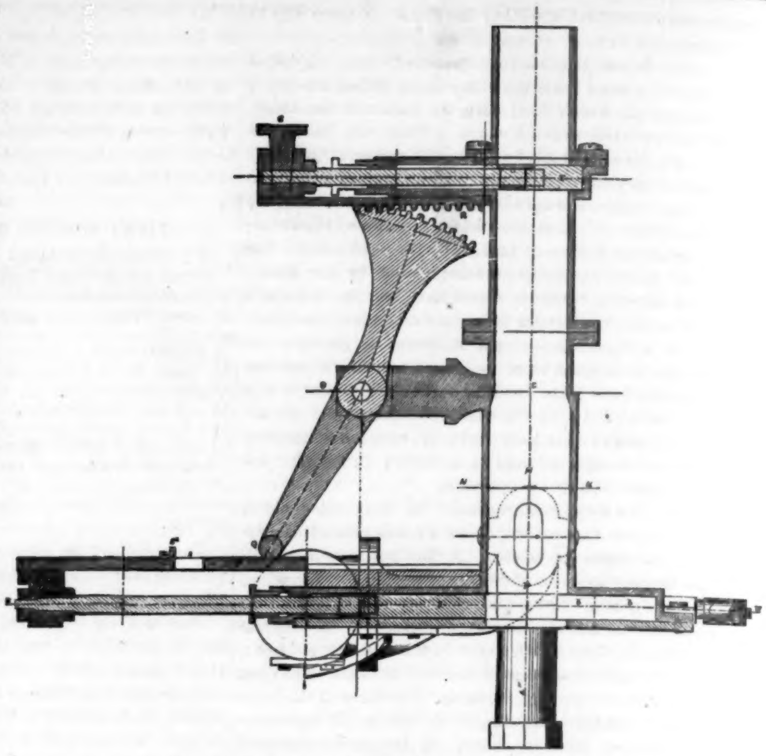


Fig. 5.—THE PNEUMATIC VALVE.

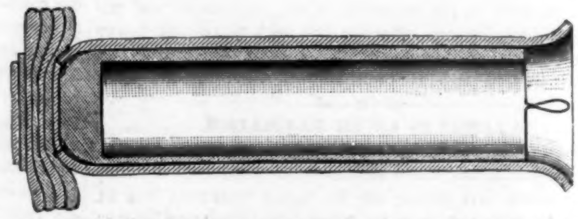
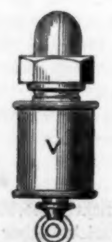


Fig. 7.—CARRIER FOR PNEUMATIC TRANSMISSION.



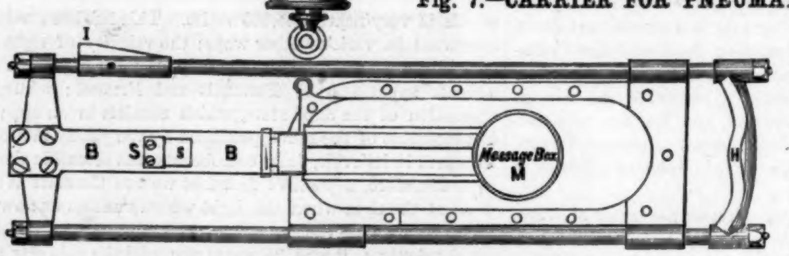


Fig. 6.—PNEUMATIC TRANSMISSION SLUICE.

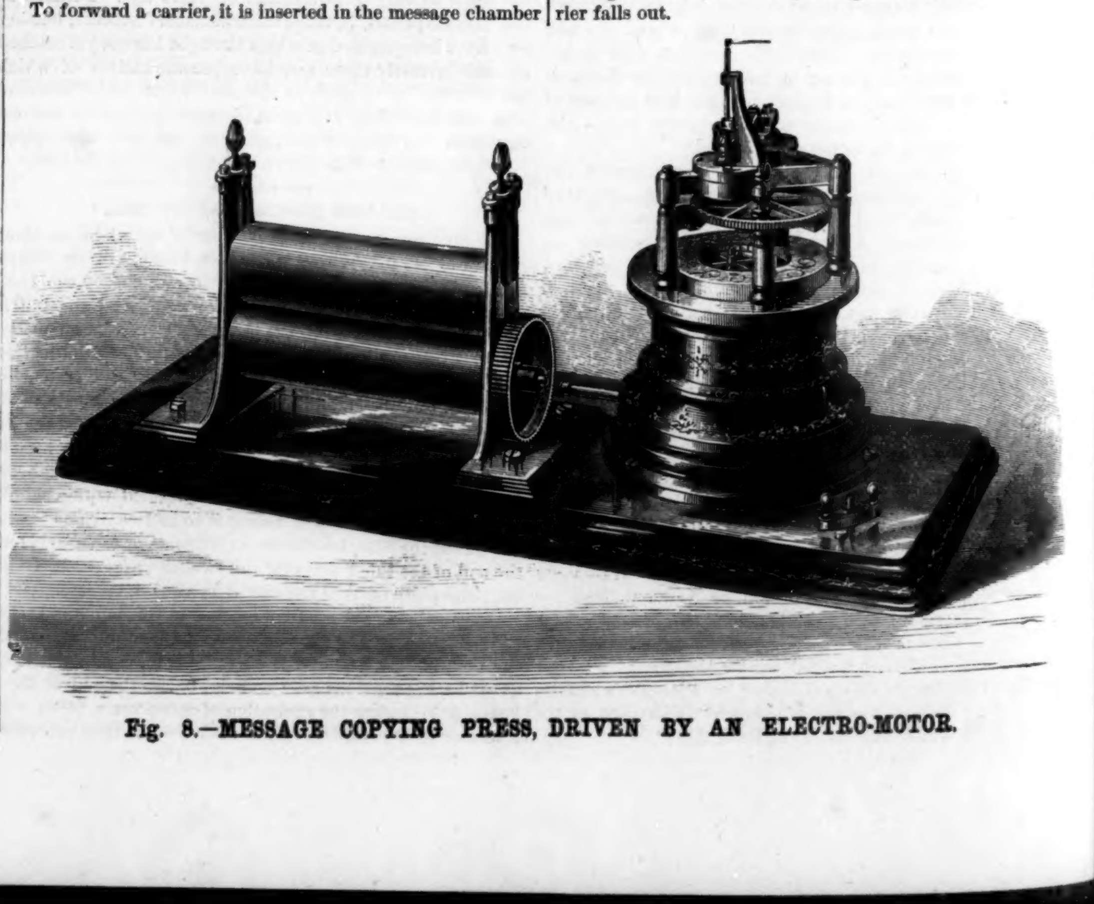


Fig. 8.—MESSAGE COPYING PRESS, DRIVEN BY AN ELECTRO-MOTOR.

A system of electric signals is used between the central station and the outlying stations, consisting of a single stroke bell with indicator, to signal the departure and arrival of carriers, and for answering the necessary questions required in the working.

The carriers or pistons in which the messages are placed are made of a cylindrical box of gutta percha, one sixth of an inch thick and six inches in length. A section of one of these carriers is shown in Fig. 7. The gutta percha is covered with felt or drugget, which projects beyond the open end of the carrier. This part expands by the pressure behind, causing it to fit the pipe exactly. The front of the carrier is provided with a buffer or piston, which just fits the brass tube. This buffer is formed of several pieces of felt. To prevent the messages getting out of the carrier, its end is closed by an elastic band, which can be stretched sufficiently to allow the message to be put in. At the branch stations, where no apparatus is required, the message tube terminates with the end downwards, above the counter or table, so that nothing can fall into it by accident.

Tubes are made of lead, iron, and brass. In London lead tubes are preferred. In Berlin iron only are used. In Paris both iron and brass are employed. In New York brass tubes are exclusively used.

All messages received at the offices of the Western Union Company for delivery, either by the tubes or by messenger, are written by the operator on the proper blank forms with copying ink, and a duplicate is taken, for filing, by laying a sheet of dampened unsized paper upon the message, and passing the two through a copying press. The latter consists of a pair of rollers, which are turned by steam power, an electromotor, or by hand, according to circumstances. Fig. 8 shows one of these presses driven by a Phelps electro-motor. This method of taking duplicate copies is much neater, and is in many other respects preferable to the manifold process employed in Europe, which is only used in this country when a large number of copies are to be taken of the same despatch, as in the case of press news.

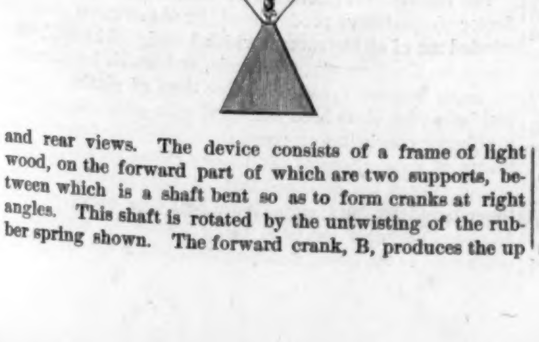
NEW EXPERIMENTS ON MECHANICAL FLIGHT.

M. V. Tatin has recently published a report of results of experiments conducted during the past year, the object of which has been the reproduction of the flight of birds by mechanical contrivances. He has studied, by the aid of small models set in motion by rubber springs, the best form of wing, in order to determine the nature of the large wings most suitable for use on a machine actuated by compressed air. After many trials, M. Tatin finds the larger proportion of advantage to be with long and narrow wings. Other investigators have already shown that a wing may be as effective when narrow as when broad, and Professor Marey has pointed out the fact that those birds which have small amplitude of wing movement always have very long and narrow pinions. With this form (Fig. 1) M. Tatin has rendered as short as possible the period during which his artificial wing takes the proper position to act on the air during its down stroke.

As a bird flies the more easily as his wings act upon large masses of air in shorter periods of time, it will be evident that the velocity of maximum translation will be the most advantageous pace in point of reduction of expenditure of power. M. Tatin, not being able to prevent his mechanical birds expending considerable power in order to obtain a useful velocity, seeks to remedy this difficulty by moving their centers of gravity forward. A bird in full flight then keeps the same equilibrium as one that soars, and its velocity is in one sense passive, new bodies of air, as it were, placing themselves under the wings. All the expenditure of power may then be utilized for suspension. In this way M. Tatin has been able to augment the weight of his apparatus without increasing the motive power.

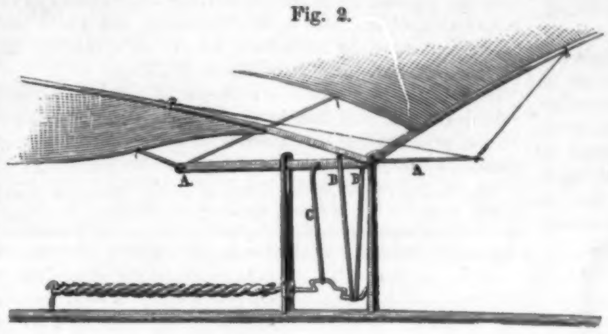
The movement which the wing makes around a longitudinal axis, and which allows it to present always its lower face forward during the up stroke, is obtained by the apparatus illustrated in Figs. 2 and 3, which are respectively side

Fig. 1.



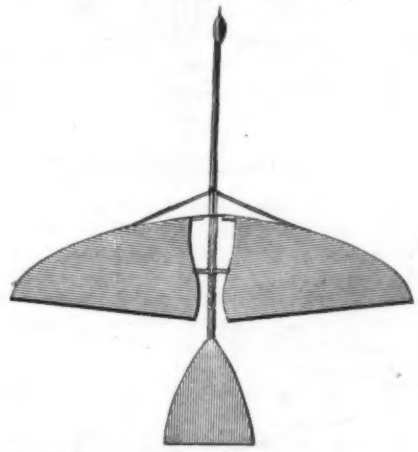
and rear views. The device consists of a frame of light wood, on the forward part of which are two supports, between which is a shaft bent so as to form cranks at right angles. This shaft is rotated by the untwisting of the rubber spring shown. The forward crank, B, produces the up and down movement of the wings, which are movable around a common axis, A. The latter is inclined downward and rearward by the second crank, C, when the first is passing its dead point, and when the wings are at the lowest position during their stroke.

Fig. 2.



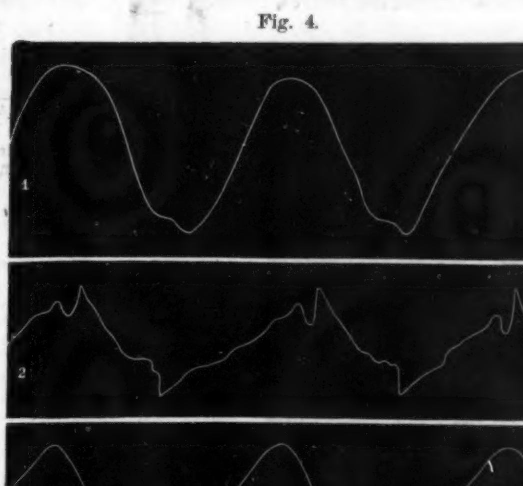
But the wing should not only change position in its entirety; each point on its area should have, especially during the up stroke, an inclination as much more marked as it is nearer the extremity. The portion nearest the body alone should keep a uniform obliquity. M. Tatin therefore con-

Fig. 3.



cluded that it would be necessary to produce this torsional movement by the wrist; and he therefore substituted, for the wings of silk hitherto used, wings of strong feathers,

Fig. 4.



which would not bend like the former, but which would slide one on the other during the torsion. This apparatus worked admirably in the model; but when tested on a larger scale the results were inferior, and led the author to return to the silk wings, which he now definitely adopts.

By means of many slight modifications in the shape of the wings, extent of their amplitude, etc., M. Tatin has finally brought his compressed air bird to a remarkable degree of perfection. He had previously made the apparatus lift a load corresponding to three quarters its own weight; now it lifts one equalling its weight. The only difficulty seems to be to cause the device to follow a horizontal course; but this can doubtless be adjusted by a suitable disposition of the tail. The value of M. Tatin's results is shown by a comparison of the curves, graphically produced on Professor Marey's registering apparatus by the motion of the wings of birds, and that of the flying machine. No. 1 in Fig. 4 is the curve produced by the up and down movement of a pigeon's wing; No. 2 is that of the mechanical wing actuated by a rubber spring; and No. 3 is that of the mechanical wing driven by compressed air. The analogy between Nos. 1 and 3 is striking. M. Tatin believes that he will soon reach a formula which will show definitely how many foot lbs. per second are necessary to cause the flight of a given weight.

FRENCH journals state that M. Henri Giffard is building a steamboat that will make 45 miles per hour.

A New Compressed Air Railway.

Some interesting experiments have lately been made in Geneva, Switzerland, on a new system of compulsion by compressed air, the invention of M. Gonin. The road upon which the invention is to be practically employed connects Ouchy, on Lake Geneva, with Lausanne, the line following a grade of 12 in 150. For two thirds of the distance, which is but 4,800 feet, traction is accomplished by metallic cables driven by hydraulic motors; over the remaining third, the vehicles are moved by a piston traveling in a long air tube and impelled by compressed air.

In the recent experiments, a section of the tube, 128 feet in length, was used. The interior diameter was 9·75 inches, and the thickness 0·46 inch. The total weight was 880 lbs. On the upper side a slit was made, with its edges flaring inwards, in which an angular valve fitted. The lateral faces of the valve were covered with leather; and it was pressed against its seat by coiled springs fastened on the outside of the tube. The piston inside the tube was composed of six cast iron disks, with leather washers between them, the latter being cut a little large so as to pack the tube tightly. The piston rod supported three rollers, which served as guides to keep the piston in the axis of the tube. Between rollers and piston, the propelling bar was attached. This was made of such a form as, when the valve in the slit above was lowered, to extend up between said valve and one edge of the slit. Its upper end then came in contact with the vehicle; and thus the motion of the piston was transmitted to the latter. In order to cause the lowering of the valve just in advance of the bar, the car carried a roller which pressed upon a band of metal which rested on the valve rods, the latter being extended up through the springs.

A small compressing engine supplied air to a reservoir, whence it was drawn at a pressure of about 12 atmospheres. The object of the experiments was principally to determine the staunchness of the valve, and in this respect, the *Revue Industrielle* states, they were entirely successful.

A NEW KEELY MOTOR DECEPTION.

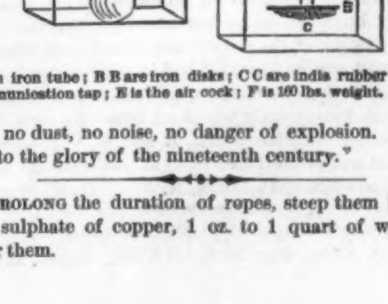
Professor E. Stebbing writes from Paris to the Philadelphia *Photographer* as follows:

"For the last few days all the *élite* of Parisian science have been deep in thought, as an engineer has given the news to the world that he had discovered a new power which would revolutionize the art of the engineer. The inventor, M. Charles Boutet, is well known; he is the author of the project of a bridge over the Straits of Dover, which would probably have been finished but for the overthrow of the French Imperial Government. Since the war he has directed his attention to hydraulic machines, and upon the following experiment he has based his idea of a new engine: He takes an apparatus composed of a two-inch bore iron tube, of a yard and a quarter long; to each end is brazed an iron disk, intended to support two india rubber balls in communication, the one with the other, by means of the iron tube. This communication can be cut off at will by means of a tap (see Fig. I.); a small tap is also placed in the tube to inflate the india rubber ball. When this is done the apparatus is pressed down into a large tank of water (Fig. I.). This requires a force which can be calculated at about 10 lbs.

"A charge of 160 lbs. can be placed upon the upper ball; and when the communication cock is opened, the 120 lbs. will be raised up (see Fig. II.). By this simple experiment it is clearly proved that a gain of 120 lbs. of force can be obtained. The author intends to avail himself of this force, and to make a 20 horse power engine for the next Exposition of Paris in 1878.

"Such is the invention of which every one speaks—a constant force obtained without expense. A machine of unlimited power, which feeds itself. No

FIG. I. FIG. II.



A is an iron tube; B B are iron disks; C C are india rubber balls; D is the communication tap; E is the air cock; F is 160 lbs. weight.

smoke, no dust, no noise, no danger of explosion. Another crown to the glory of the nineteenth century."

TO PROLONG the duration of ropes, steep them in a solution of sulphate of copper, 1 oz. to 1 quart of water, and then tar them.

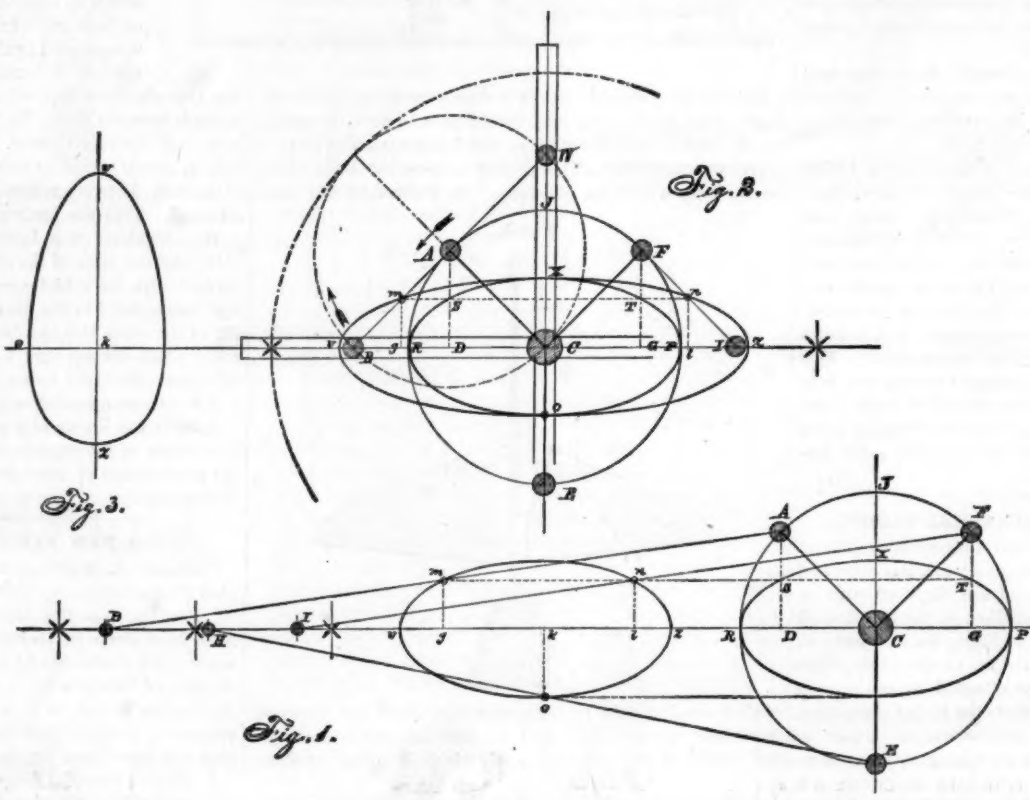
Communications.

The Curve Described by a Point on a Connecting Rod.

To the Editor of the Scientific American:

In your issue of January 20 appears a note from W. H. P., in which he repeats the erroneous statement that the path of a point on the connecting rod, between the crank pin and crosshead centers, is always an ellipse: adding that an instrument constructed on that principle would be a most perfect elliptograph. A trial would convince him of his error, and that would do no harm; but as some one else may be misled into such an experiment, by supposing that W. H. P.'s diagram proves the truth of his assertion, it may be worth while to point out that, on the contrary, it clearly proves its fallacy.

Let the circle in Fig. 1 be the path of the crank pin; if we draw ordinates, AD, JC, FG, and bisect them, the curve, RXP, through the points of bisection, is an ellipse: and the equal ordinates, SD, TG, are equidistant from the minor axis. Now let *o*, the middle point of the connecting rod, EH, be the tracing point; then *ok* will be the greatest ordinate of the described curve, and equal to CX. But it will not be at the middle of *vz*, the length of the curve, nor will equal ordinates be equidistant from it. For instance, *mg*, *nl* are ordinates corresponding and equal to SD, TG. But the triangles, ABD, FIG, having the same hypothenuse and the same altitude, have equal bases; the triangle, HEC, has the greater altitude, CE, while the hypothenuse is the same, therefore its base, HC, is less than B D or I G, and as *g*, *k*, *l* are the middle points of these bases, *gk* is greater than *kl*. The curve in question, then, is *not* an ellipse, nor is it symmetrical with respect to any transverse line; if not "slightly wider" at one end than the other, it is at any rate slightly longer.



The deviation from the elliptical form may not be great under all conditions, but it exists in all cases, with one exception, and is sufficient to preclude the adoption of what is usually understood by the "crank and connecting rod movement" in an elliptograph. The exceptional case I mentioned in a former note; if the length of the connecting rod be equal to that of the crank, and the stroke of the crosshead four times as great, the described curve will be a true ellipse. Such an arrangement would hardly be adopted in a steam engine, but is perfectly practicable in a drawing instrument. The movement is shown in Fig. 2, which is lettered to correspond with Fig. 1. It is also clear that in this case the tracing point being as before at the middle of the connecting rod, the whole length, *vz*, of the described curve will be 1½ times RP; and in order to prove it a true ellipse, it will suffice to show that all the abscissas are increased in the same proportion, the ordinates remaining the same as in RXP. Now, when the crank pin is at A, the crank and connecting rod, AC and AB, form two sides of the isosceles triangle, CAB, whose base, BC, is bisected at D by the ordinate, AD, of the circle: which, itself being bisected at S, gives SD, the ordinate of RXP, to which *mg* is equal. But A B being bisected at *m*, *ms* or its equal, *gD*, is the half of BD or of its equal, DC; that is, C*g* is 1½ times CD: and so of any other position of the crank. It may be added that the movement of AB, the connecting rod in this arrangement, is identical with that of the pencil bar in the common trammel, which will be seen by prolonging BA to meet the vertical center line in W; for in that case the triangle, CAW, being also isosceles, it is clear that, as B moves to and fro on the horizontal line, W will rise and fall in the vertical line: and if these points be compelled to travel in those lines by the slots as shown, the crank may be removed without affecting the result. The mechanical device of the crank, however, gives some advantages; one of which, it may be mentioned, is that, by altering the length of the connecting rod, the instrument may be adjusted to draw curves which are not elliptical, but very decidedly egg-shaped; Fig. 3, for example, would hardly be mistaken for an ellipse by any one.

It may be of interest to some to note that the result attained by either of the devices mentioned, and illustrated in Fig. 2, may also be accomplished in another manner. If the wheel shown in dotted lines, whose center is A in that figure, roll within the annular wheel of twice its own diameter, whose center is C, the points, B and W, will move in the horizontal and vertical lines, and *m* will trace the ellipse.

Stevens Institute, Hoboken, N. J. C. W. MACCORD.

THE average weight of 20,000 men and women, weighed at Boston, Mass., was: Men, 141·5 lbs., women, 124·5 lbs.

Supporting a Ball on a Blast of Air.

To the Editor of the Scientific American:

In looking up some other matters, I came across an account of some experiments in the direction indicated by the above title, which may possess some interest, and furnish some suggestions in connection with the experiments of the same character exhibited at the Centennial, and which have been discussed in the SCIENTIFIC AMERICAN within the last two months. See page 262, volume XXXV.

In the Glasgow *Mechanic's Magazine* for July 2, 1825, volume LXXX., page 338, in an article entitled "Account of several experiments, performed with a compressed gas apparatus, by John Deuchar, Esqr.," occurs the following:

"*Experiment* 1. When a common brass blowpipe nozzle is put upon the top of the condensing gas-holder, a mahogany ball will be supported upon the column of gas as it is allowed to escape; and when the ball is at the distance of from one inch to one and a half inch above the opening, we may inflame the gas, and still the ball will be supported, and perform a double rotatory motion in the center of the flame (as shown in Fig. 1). Although this experiment be continued for five minutes, yet the wooden ball is not burned, nor even much warmed. In order to mark the motion of the ball, it has a white ring round it.

"There are two causes which operate here in keeping the temperature of the ball below the point of combustion. The first is the hollow nature of flame; it is on the outer surface of the gas alone that the combustion takes place, for there only it has the necessary supply of oxygen to carry on its combustion; the interior, therefore, in which the ball is situated, consists of a mixture of the gas, partially scorched or converted into smoke, united with some that has not been at all changed. And, secondly, the rapid rotatory motion of the ball further prevents the action of the interior uninflamed column of gas, and completely prevents the wood burning.

"*Experiment* 2. Repeat the last experiment, and, at the same time, incline the apparatus to one side, and we have the ball supported on a column of flame obliquely, even at an angle of nearly 45° (as shown in Fig. 2), from the perpendicular. The inflammation of the gas in this instance shows how correct Professor Leslie's ideas were with regard to the nature of the phenomenon which he, I believe, first noticed, of a column of air supporting a hollow brass ball at an angle of 45°; namely, that the ball was enveloped by a sheath of the air; and the inflammation of the gas renders, so far, unnecessary any mathematical demonstration with regard to that point.

"Here is shown, in a very beautiful manner, the inflamed sheath of gas surrounding the ball, by the rapid motion and force of which it is that the ball is enabled to resist the power of gravitation even at the inclination of an angle of 45°; but when we slant the apparatus more to one side, we then find that the attraction of gravitation becomes stronger than the propelling force of the inflamed gas, and we see the ball drop through the burning sheath in which it was previously enveloped.

"In alluding to the very curious observation of Mr. Leslie regarding common air, I cannot help stating that, in the *Chemist*, volume I., page 381, it has, by misrepresentation, been attempted to make it appear that the learned Professor had claimed the merit of discovering that a brass ball could be supported on a column of water. Now, so far as my information goes, Mr. Leslie leaves the far less singular circumstance of a ball being supported on a perpendicular column either of water or air, to be claimed as the discovery of those earlier philosophers, from whose ingenuity the Swiss and German schoolboys (of whom the correspondent in the *Chemist* speaks so highly) had learned their amusing recreation; but the Professor deservedly, I think, is entitled to the merit of first proving that a brass ball could be supported upon a column of water or of air, when that column is inclined even to an angle of 45° from the perpendicular."

In the volume of the *Chemist* referred to, which I chance to have also in my library, I find on page 15 the following:

"HYDRAULICS.—*Curious Experiment.*—The following experiment has recently been exhibited in the northern part of this country by a celebrated professor. A jet of water, by means of a great pressure, was made to spout upwards, and bear aloft, almost as high as the ceiling, a hollow copper ball as large as an egg; and sometimes an egg itself is used. The water was made to spout up in one unbroken jet, about the thickness of a lady's finger. Striking the ball on the under side, it spread out into a thin shell or film, which invested the globular surface on all sides, and afterwards descended in rain or spray. The ball kept playing on the top of the jet, not leaping up and down, but vibrating a little from side to side, and generally it performed at the same time a slow vertical motion on its axis. It is remarkable that it is not necessary for the water to rise in a vertical direction. The experiment succeeded, and the ball was supported equally well, when the jet was inclined ten or fifteen degrees."

And on page 175:

"CURIOUS EXPERIMENT.—We mentioned some months ago an experiment exhibited in Professor Leslie's class room, in which a hollow brass sphere was balanced on the top of a jet of water, and made to play up and down, in a manner very striking and beautiful. We saw the Professor exhibit subsequently an experiment of the same kind with air, but of a more novel and singular description. Two or three atmospheres of common air were condensed into a close copper vessel, of a size which might be conveniently carried in the hand. A stopcock, with a very minute aperture, fixed on the top of the vessel, being opened, the condensed air rushes out in a stream.

If a wooden ball of the size of a schoolboy's marble, or larger, is placed by the band in this current of air, it is not blown aside or suffered to fall, as we would expect, but continues to leap up and down some inches above the orifice, generally performing at the same time a vertical revolution round its axis. Though the air and water in the two experiments perform the same office, they act in a very different manner. The water, thrown up by pressure, rises in one unbroken filament, of the thickness of a slender rod, to the height of twenty feet or more; but the air being greatly condensed, the moment it escapes from the tube its particles exert a lateral repulsion, and, instead of pouring upwards in a uniform slender stream, it spreads out into the form of an inverted cone, in the axis of which, where the rarefaction is great, the ball plays up and down. So securely is the ball confined by the conical shell of air which invests it, that the vessel may be inclined at an angle of 30° or 40°, or carried about freely in the hand, without the ball falling off. The experiment has, in fact, something of a magical effect; for, when viewed at a distance of three or four yards, so that the whizzing noise of the air is not heard, the ball seems to leap and play, and attach itself to the vessel by some secret and invisible power of its own.—*Scotsman.*"

The article alluded to as occurring on page 381 is simply a rather unamiable criticism on something which was *not* asserted concerning Professor Leslie, and is not worth repeating.

Various experiments closely related to the above under the general title of the pneumatic paradox have been frequently discussed and may be found in some text books; but it is curious to see how the supporting of a ball by an oblique blast of air has died out of recollection.

I have encountered in many places a general reference to investigations of Faraday on the above subject, but have found no trace of them as yet among the list of his papers given in the "Catalogue of Scientific Papers" published by the Royal Society, nor have I encountered any publication by Professor Leslie in relation to the matters quoted above.

HENRY MORTON.

Stevens Institute of Technology, Hoboken, N. J.

A Segmental Parabolic Reflector.

To the Editor of the Scientific American:

The descriptions published of the so-called Balestrieri reflector (repeatedly pre-invented by Americans) have reminded me of an instrument which I designed in 1867, when living in Mono county, California, and which has remained on paper because I had no chance then of getting it made, and have ever since been occupied with other affairs. It is a reflector consisting of concentric parabolic rings or segments of copper, coated inside with nickel or silver, which are so curved and arranged that all solar rays falling upon them parallel with their axis are bent to a common focus. In consequence of the latter being behind the reflector and quite near to the same, manipulations which would be very

difficult or impossible to perform in front of a concave mirror are rendered perfectly convenient. The reflector may be so mounted as to enable the operator to keep its axis directed towards the sun, and thus to maintain a complete focus for a considerable space of time; and means may also be devised for separating the solar rays by filtration through proper absorbing media. Any good physicist will know, without being furnished with a diagram, how to construct the instrument, which may, indeed, be done in somewhat different ways, it being necessary only to give to the concentric rings or segments (which might best be made by depositing copper upon moulds of wood, covered with plaster and correctly shaped on a lathe) such a curvature and position that the parallel rays, striking them at various angles of incidence, be reflected to the same point. There can be no doubt that, with a large reflector of this kind, it will be possible to produce calorific effects of which we have at present no conception; and the instrument may not only become an important aid to Science, but may also find some useful applications in the arts. By the Balestrieri reflector, which consists of concentric conical rings or segments, the solar rays can naturally not be brought to a focus, but only be collected in an axial line. Its proper purpose is to cast the light of a focal flame in a certain direction into space, and it must answer that purpose quite well. A. PARTZ.

Paris, France.

Plant Vigorous Young Trees.

To the Editor of the Scientific American:

On page 70 of your current volume, you advise farmers and fruit growers to buy small trees rather than large ones. In a general sense you are perhaps correct; but practical pomologists know that to judge rightly of the value of a tree by its rings alone is quite impossible, there being other conditions of growth quite as important, and even more so, than the relative size and height of its trunk and branches. Having a pretty extensive experience in the planting and growth of young fruit trees especially, I have found the roots to be the most important consideration, and the best indication of vigor and quality; and were I compelled to purchase trees without seeing them, roots and all, I should much prefer seeing the roots than the trees proper; and indeed, with such evidence of their quality, I could not be greatly deceived. A tree with a fine mass of fibrous surface roots of a healthy, vigorous color, and thin, small, rather than thick, broken main roots, is sure to grow and thrive with any sort of fair treatment, and in almost any soil; but without such fibrous roots, and having only two or three large mutilated horns or prongs, and a heavy stub for a tap root, which must from necessity have been broken and skinned in removal from the nursery row, the tree were better thrown on the brush heap than given space and trouble in the orchard. In view of the fact that most of our nurserymen work their trees upon seedling root stock and leave them standing in the rows where first planted, it is easy to understand why so large a percentage fails to grow and thrive when removed to our gardens and orchards, and why in some cases, with the utmost care and attention, so many years of doubt and uncertainty must intervene before the fruit appears. In the deep fertile soil of the nursery, they send down long tap roots which, if left undisturbed, grow to the exclusion of anything in the shape of fibrous roots; and when the trees are finally removed for sale, this long tap root must of course be cut or broken off, and it is thus somewhat miraculous if the tree lives at all.

To buy only small trees will not entirely obviate the difficulty, although it is in every way poor policy to purchase or plant very large trees of any kind. But in procuring small trees, it is very important to know various other attending conditions: whether they are small simply from a stunted condition of growth and general lack of constitutional vigor, or because they are young, which of course is the only admissible condition. I have trees of three years which far surpass in vigor and size others of ten. I would certainly prefer even large trees, if vigorous, to small, stunted trees of like age. So it will be seen it is not safe to rely upon small trees altogether. A better rule would be perhaps to buy young trees rather than small, if, indeed, the matter can be narrowed down to one short invariable rule, which I very much doubt. Show me the roots of a tree, and I'll tell you how it looks above ground. Look at the roots first, then the wood and bark; do not care about the size so much, and you need not inquire very particularly about the age after having made the examination indicated. All reliable nurserymen are well acquainted with these facts, and should not mislead their customers in their catalogue classifications. The real, true quality of a fruit tree exists in its degree of vigor and thrift; and it is with reference to this, together with age, that the various grades and prices should be arranged.

Kingston, N. Y. H. HENDRICKS.

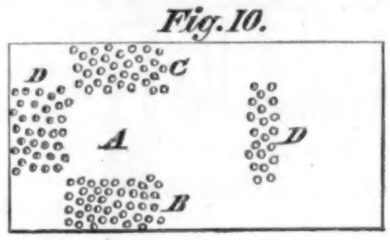
STRAIGHTENING WROUGHT METAL PLATES.

No. II.

As an example, let us take a plate, say 18 inches by 24, as in Fig. 10. The first thing to do is to ascertain where it is out of straight, which is done as follows: If it is a thin plate, say of 19 gauge, we rest one end of it on the block and support the other end in the left hand, as shown in Fig. 11; then with the right hand we exert a sudden pressure in the middle of the plate; and quickly releasing this pressure, we watch where its bending movement takes place. If it occurs most at the outer edges, it proves that the plate is contracted in the middle; while, if the center of the plate moves the most, it demonstrates that it is expanded in the middle. And the same rule applies to any part of the plate. This way of testing may be implicitly relied upon for all plates or sheets thin enough to be sprung by hand pressure.

Another plan, applicable for either thick or thin plates, and used conjointly with the first named, is to stand the plate on edge with the light in front of us, but not overhead, as in Fig. 12; we then cast one eye along the face of the plate upon which the light falls, and any unevenness will be made plainly visible by the shadows upon the surface of the plate. The eye should also be cast along the edges to note any twist or locate any kinks. Perhaps our trial by these tests, employed either singly or in conjunction, demonstrates the plate to have the bulge in it, denoted in Figs. 10 and 11 by the inclosure within the line, A. This bulge is called a loose place; and if the plate is bent or springs back and forth a little, this spot will be found to move the most. The plate is, in fact, edge-bound, as it might aptly be termed; and hence, to straighten it, we do not attempt to batter the bulge down by placing the plate on a large block and hammering away at the convex side; but we place it on a small block and proceed to stretch the plate at and near the edges, and so remove the bulge or loose place without hammering it at all. The method of attack is to first hammer the plate, letting the first series of

Fig. 10.

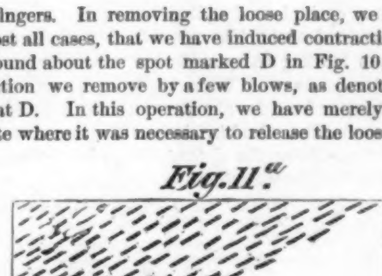


blows be delivered as denoted in Fig. 10 by the marks at B; and we then deliver the blows denoted by the marks at C and at D in the same figure. These blows will, if sufficient of them are delivered, remove the loose place. While giving these blows, the workman takes care to hold the plate so that his blows fall solid and do not "drum:" that is to say, if the spot where the hammer falls does not rest upon the anvil, the effect of the plate is similar to that produced by a drumstick upon a drum, producing no result save to jar the fingers holding the plate. And this jar is frequently sufficiently great to cause severe pain and sometimes injury

Fig. 11.

to the fingers. In removing the loose place, we shall find, in almost all cases, that we have induced contraction in the plate round about the spot marked D in Fig. 10; and this contraction we remove by a few blows, as denoted by the marks at D. In this operation, we have merely stretched the plate where it was necessary to release the loose place.

Fig. 11a.

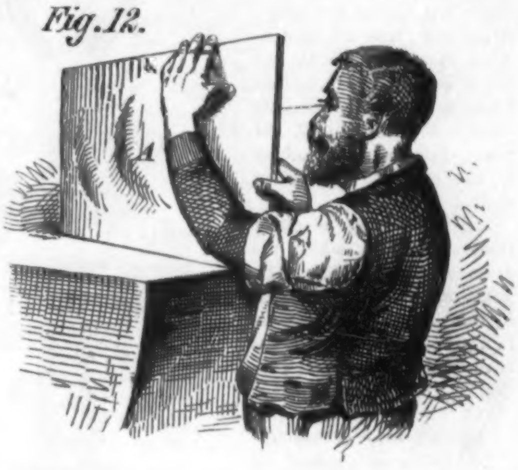


Let us now suppose that our testing had shown the plate to be twisted. We then carefully note which edge of the plate is the straightest, and which is the one that is bent, and then place our plate upon the anvil, as shown in Fig. 11a, in which that part of the plate on the left hand side of the diagonal line is supposed to be the one that is bent, the bend lying downwards (the edge, A, being the straightest). We then attack the plate, if a thick one with the long cross face hammer, and if a thin one with the twist hammer; and in either case we deliver the blows denoted by the marks, the action of the hammer being to lift the plate in front of it. The blows at and towards the edges are always delivered first, the hammering being carried towards the middle, and being also wider apart as the middle of the plate is approached.

A plate is said to be contracted when the hand bending process shows the edges to move the most; and in this case all that is necessary to remove the contraction is to strike the plate a few blows about the contracted part, as we did to remove the contraction at D in Fig. 10. The blows in this case, however, may fall perpendicularly, and be delivered (for fine work) with a broader faced hammer.

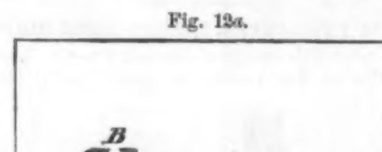
To remove a kink or crooked place at or near the edge of a plate, we proceed as shown in Fig. 12, laying the plate with the convex side of the kink resting upon the anvil (the shaded part, A, representing the kink), and delivering the blows denoted by the marks at B, in Fig. 12a. We next turn the plate upside down, and strike the blows denoted by the marks or dashes at C, Fig. 13; and the kink will be removed.

Fig. 12.



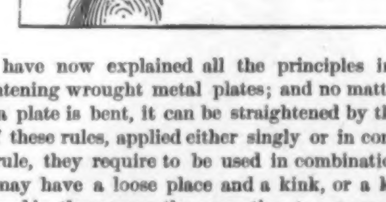
To straighten the plate shown in Fig. 9, we place it upon the anvil, as shown in Fig. 14, striking blows as denoted at A, and placing but a very small portion of the plate over the anvil at first; and as it is straightened, we pass it gradually further over the anvil, taking care that it is not, at any part of the process, placed so far over the anvil as to drum, which will always take place if the part of the plate struck does not bed, under the force of the blow, well upon the anvil.

Fig. 12a.



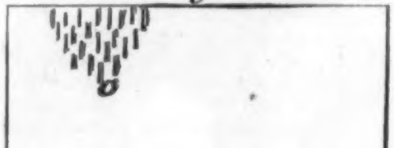
We have now explained all the principles involved in straightening wrought metal plates; and no matter in what shape a plate is bent, it can be straightened by the application of these rules, applied either singly or in combination. As a rule, they require to be used in combination: thus a plate may have a loose place and a kink, or a kink and a twist, and in these cases the operation to remove the one is

Fig. 13.



performed conjointly with that necessary to remove the other, either being slightly modified to suit the other operation. The anvil, it will be seen, must be small enough to permit of the plate being attacked in individual spots or places; for the plate must always lie so that the part being struck is solid upon the anvil. In consequence of this requirement, the holding of the plate becomes an important element; for, with a good helper, the plate may be quickly and readily adjusted, thus saving much time and labor.

Fig. 14.



A rude system of straightening is sometimes performed by the aid of a trip hammer, the finishing process being performed on a large iron block. This plan is crude, however, and is more productive of hammer marks than it is of true work. Very thick plates, those too thick to be readily affected by the blows of a sledge hammer, are made red hot and straightened upon iron blocks larger than the plates. For this operation large wooden mallets with very long handles are sometimes used. J. R.

OVER 13,000 applications for space have already been filed by the authorities of the French Exposition next year; 7,800 are from the city of Paris alone.

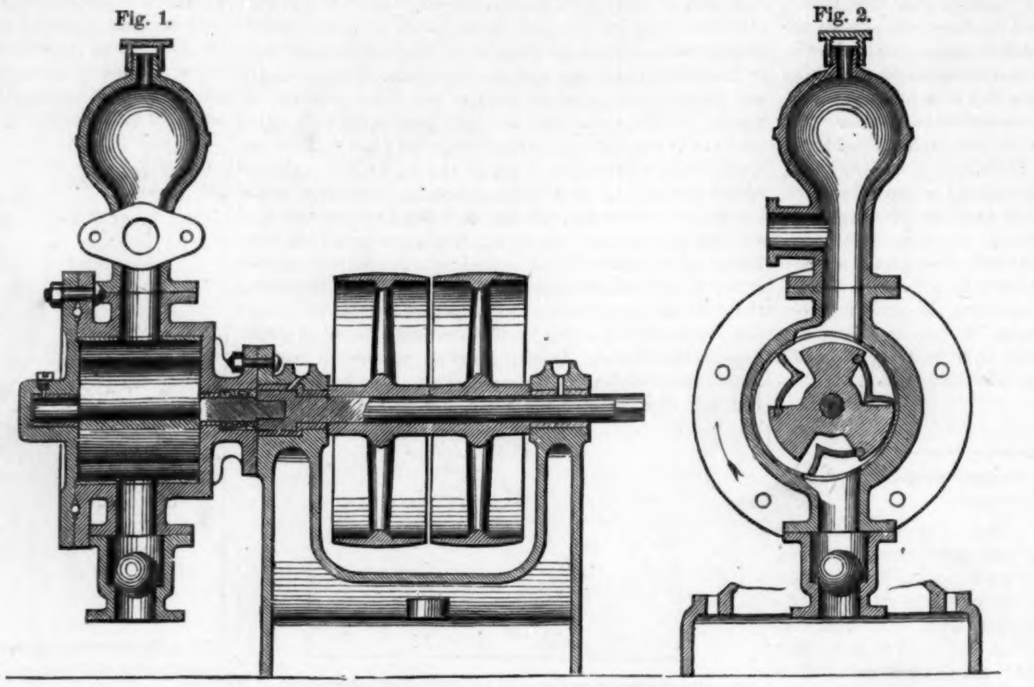
NEW ROTARY PUMP.

We extract from the *Revue Industrielle* the annexed engraving of a new rotary pump, which is quite simple in construction, and which, our contemporary states, has successfully withstood quite severe tests.

Placed eccentrically in the cylinder is a drum, as shown in Fig. 2, to which are hinged three bronze pallets which close into recesses in the drum. These, as the drum rotates, draw in the water through the ball valve in the suction pipe below. The drum shaft is mounted independently of the pulley shaft, Fig. 1, so that any strain on the latter, by the belts, will not tend to throw the pump mechanism out of line. The connection between the shafts consists simply of the end of the drum shaft entering a socket in the end of the pulley shaft.

The pallets may be easily removed without taking the drum from the cylinder. The joints of the cover are packed by rubber packing, which fits in a groove made half in the cover and half in the cylinder.

Fig. 1. Fig. 2.



HOUYOUX'S ROTARY PUMP.

Dyeing Raw Cotton.

The following is considered the best and easiest way for dyeing raw cotton. Boil with 22 lbs. extract of logwood for 100 lbs., till it is all well penetrated, then dry; then boil slowly with 10 lbs. chromate of potash and 5 lbs. soda crystals; make run the liquor, take out, and keep over night, or one or two days; then wash well. That is the best and fastest black, and stands well.

A NEW PHYLLOXERA REMEDY—DECORTICATION.

It was recently announced in the French Academy of Sciences that the decorticating or removing of the bark from

Fig. 1.—SABATE'S DECORTICATING GLOVE.

grape vines is a valuable preventive of phylloxera ravages, and that the vines thus treated also soon showed very perceptible signs of improvement in vegetation. M. Sabaté now gives, in *La Nature*, some positive facts regarding the efficacy of this process, based on actual trials in his own vineyards. He states that a plot of about 20 acres had its vines (white grape, age 60 years) nearly destroyed in 1875. During the winter of 1875-6, the vines were barked during the coldest weather. They have since become in a flourishing condition, and last autumn yielded an amount of grapes double that of the preceding year; and 48 acres of other vines (red grape, aged from 15 to 20 years) were similarly treated in February, March, and April. Since then they have not been attacked, and the old phylloxera points of lodgment have not enlarged, while a far larger yield was obtained. In general, the vegetation in both of these vineyards offered a striking contrast to that in adjoining ones where decortication had not been practised. Although the vines in the latter were planted in fully as rich soil, and were identical in variety and in age, they are now as badly attacked as at any time during the past two or three years. Indeed, their production is lessened, and is scarcely 60 per cent of that of last year. These facts have attracted official notice, and a committee from different French vine growers' associations have lately undertaken and completed an extended course of experiments based upon them. These substantiate the conclusions drawn from the foregoing, and also show the further benefit that, by removing the bark, a large number of harmful insects, which take refuge therein in winter, are at the same time destroyed.

The modes of decorticating the vines are represented in the annexed illustrations. The workman wears a glove, Fig. 1, made of mail or rings of galvanized iron. It weighs about 20 ozs., and with it a man can easily bark 500 large three-branched trunks per day. Fig. 1 shows how the bark is removed by rubbing the branch longitudinally. In order to reach crotchets and sharp angles, the bow, shown in Fig. 2, is used, the cord being a twisted line of galvanized iron wire.

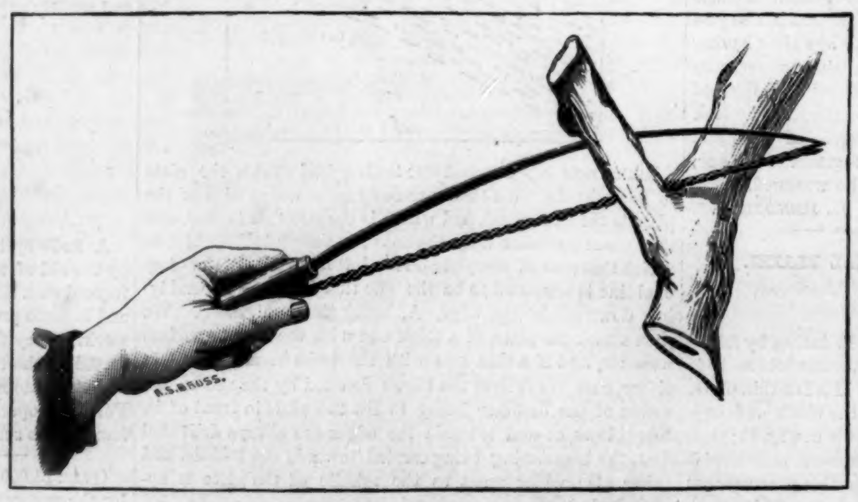


Fig. 2.—SABATE'S DECORTICATING BOW.

A Machine Switchman.

About as curious a railway signal as we have ever seen has recently been patented through the Scientific American Patent Agency by Mr. J. D. Hughson, of Prairie City, Ill. This inventor believes that, where an engineer might fail to heed the indication of a semaphore or some other purely mechanical apparatus, he would be sure to notice the frantic gestures of a man posted beside the track. As men of flesh and blood cannot probably be found who would be willing to stand on a high pedestal for indefinite periods of time and wave their arms at exact intervals, a machine man has been contrived who flourishes a flag, hammers a bell, and displays a changeable light in his hat with unfailing regularity. The man owes his movements to clockwork operated by weights, and the latter are controlled by electricity. When a train passes, it moves a little stop beside the track, which, by a mechanical connection, shifts a switch so that the current from a main line of telegraph wire is diverted into a short circuit. An electro-magnet inside the machine man is thus excited; and as it attracts its armature, the latter releases a detent. The weights then descend, and the man waves his flag and pounds his bell, while the light on his hat changes to red. When the train has passed, the current is broken from the short circuit, but the man keeps on his motions until a wheel in his interior completes its revolution and thus allows the detents once more to engage. Of course the time during which he waves his flag, etc., is long enough to allow the train that has passed to travel a considerable distance.

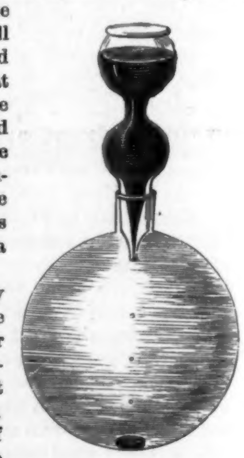
The Coffee Photographic Process.

A correspondent in Switzerland lately sent some examples of this process, which, by reason of their depth, vigor, and richness, were equal to the best wet-plate photographs; and now both M. Haakman, the President of the Photographic Society at Amsterdam, and M. Victor Angerer, a well known Viennese photographer, bear testimony to the efficacy of the process. M. Haakman says he has given some attention to dry plates, for, as he practises photography simply for pleasure, these are generally more convenient to use than wet films. He has tried, he tells us, tannin, tea, tobacco, morphine, and several other substances in the preparation of his dry films; but none of these, to his thinking, afford such clean and satisfactory films as coffee.

M. Haakman prepares his plates in the simplest manner; and although we have several times published formulæ in regard to the production of coffee plates, our readers may like to know the precise plan followed by M. Haakman. His coffee solution is made up of: Boiling water, 6 cubic inches; pure Java coffee (burnt), 77 grains; white sugar, dissolved in a little water, 39 grains. This infusion, when cold, is poured twice over the sensitized collodion films, which are then dried.

A NEW BATHOMETER.

We extract from *La Nature* the annexed engraving of a new and simple instrument for measuring great sea depths. It is the invention of Dr. H. Fol, and consists of a spherical glass reservoir filled with a liquid very slightly compressible—water, for instance, or, better still, ether. The only orifice to the vessel is a capillary tube which communicates with a small reservoir above, which is filled with mercury. The latter, at the presumed temperature of the water at the sea bottom, should just stand at the level with the orifice in the pointed stopper inserted in the large reservoir. The upper surface of the mercury is exposed to contact with the sea water.



In using the device, it is simply lowered by a sounding line. The liquid within the large reservoir will be compressed as the apparatus descends, a given amount for each atmosphere of pressure, and a corresponding quantity of mercury will escape through the orifice and sink to the bottom of the large reservoir. This mercury on the apparatus, being hoisted, is accurately weighed, and its weight indicates exactly the pressure to which the device has been submitted. The pressure known, the depth of water is easily determined.

Do not Allow the Frogs to be Pared.

The frog of the foot of every horse is the natural support of the foot, and should never be cut away except to remove the rough edges which occasionally appear from common wear. At a late meeting of the farriers and horseshoers in Wilmington, Del., there was a great deal said in condemnation of the manner in which horses are shod, especially in the rural districts. A lecturer, a veterinary surgeon (according to the New York *Herald*), said that "the frog of the foot was often pared away so artistically to make a neat job that the tendon or muscle that extended down the leg, over what is known as the pulley bone, and gave the foot its motion, was often injured, and then the horse would be weak in the legs, and blunder. He severely characterized the habit of burning the hoof with a red hot shoe to make it fit, and said there ought to be a law passed to hang any blacksmith who would use red hot shoes in this way. The shoe should be fitted to the shape of the foot, rather than the foot fitted to the shoe."

AN electric battery, famous because it was once owned and operated by Benjamin Franklin and other distinguished philosophers, has been in use at Dartmouth College for years, and is now employed almost daily for class-room experiments.

A PERSIAN DWELLING.

There is little to be seen in modern Persia that tends to substantiate the tales of ancient travelers concerning the magnificence and wealth of the cities ruled by the Shah. Colossal ruins attest the grandeur of former days, but centuries of misgovernment have reduced a people naturally industrious and energetic to a mere horde, existing under scarcely more than the semblance of civilization. Persia, or rather her cities, might be termed the abode of shams; for deception reigns everywhere, from the huge paste diamonds of the Shah to the imposing pillars of dust and straw which decorate the wretchedly constructed buildings.

An excellent idea of the exterior of a Persian dwelling of the better class in Teheran is afforded by our engraving. The courtyard, and probably the most attractive portion of the structure, is represented; and the picture shows nothing of the intolerable filthy surroundings of even the finest private grounds. The materials of construction used are sun-dried bricks, which have little cohesion, and which before long render the walls in a very dilapidated state. The elaborate cornice and columns represented in the engraving are scarcely more stable than so much theatrical scenery, being merely of wood stuccoed over with mud. In some structures stone is used, and tiles are employed for decorative purposes; but this more substantial mode of building is confined to the houses of dignitaries, or to the bazaars or mosques. In the latter the relics of past magnificence are yet discernible, and one edifice is asserted to be roofed with plates of pure gold. In view of the acquisitive nature of Persian officials, and the unconcealed corruption which reigns in every department of the government, the statement that so much treasure is allowed to remain unappropriated to some one's private use is rather questionable. Persian architecture, however, is not without its importance; and as it involves the application of the singularly beautiful arabesques known the world over as Persian patterns, it presents suggestions to our designers and decorators, of which at the present time advantage is widely being taken. The arches shown in our engraving are by no means of the conventional pattern, and are exceedingly graceful; while there is a harmony of design between the general form of the building and its flat decoration which appeals strongly to correct taste. To perceive to what excellent use it is possible to turn the Persian arabesque and the closely analogous Moorish designs, the reader has only to examine the architecture of some of the larger Jewish temples in this city. There—where, as a matter of course, the Gothic and other well known styles which, by custom, are almost wholly appropriated to Christian churches, would not be suitable—architects have been compelled to seek other sources for every variety of decoration; and the results are adaptations of Oriental design, pleasing both intrinsically and because of their non-conventionality. Workers in other branches of art have likewise recently resorted, to an unusual degree, to Persian ornamentation, and some of the most exquisite productions in *repoussé* silver and niello work are based entirely upon Persian patterns.

Individual design apart, the aspect of groups of Persian houses is not inviting, but rather monotonous; and the eye finds its only relief in the courtyards or in the gardens, where trees are allowed to grow. The interiors of the dwellings, especially those of the richer classes, often, however, bespeak an unlooked-for degree of comfort: that is, if comfort can be had in any structure which is liable to fall down unless constantly repaired. The courtyard represented in the engraving is entirely inclosed by the dwelling, and is reached from the street by a narrow corridor. On two sides of it are simple blank walls; on the others are the fronts of two distinct buildings (one of which is represented), one belonging to the master of the house and the male portion of the household, the other to the harem. Each consists of a large saloon, separated from the courtyard by glass windows, with two smaller apartments on the ground floor, and a balcony chamber above. The flat roofs are reached by an uncovered flight of steps, and are places of frequent resort in the warm season after nightfall. In winter the rooms are heated by jars of charred fuel, half buried in the floor. The houses of the richer classes in Teheran are seldom occupied during the summer, as, owing to its filthy condition, the city then becomes unhealthy. The monarch and aristocracy then betake themselves to tents on the neighboring plain of Sultanieh; while the rest of the population accept the ravages of pestilence with that fatalistic indifference peculiar to Oriental races.

Some Astronomical Notes for March.

A writer in the New York *Tribune* says that March is in many respects an important month. The sun, which has all winter long been south, is now rapidly approaching the north, and will cross the equator at 7:16 (New York time) on the morning of March 20. This point is called the vernal or spring equinox. Many of our young readers know that there are two equinoxes in a year, the verbal equinox in March, the autumnal in September. A simple illustration will probably help them to understand better the meaning of the terms equinox and equinoctial points. Take two large hoops. Place one inside the other, and hold them horizontally. Now tilt the inner hoop a little, so that half of it is above and half below the other hoop, which remains horizontal. Let the latter represent the equator; then the tilted hoop will stand for the ecliptic round which the sun travels in a year. A glance at the two hoops will show that the ecliptic can only cross the equator at two points. These are known as the equinoctial points, and also as the equinoxes, because when the sun is in these points the days and nights at all places are supposed to be equal. Not that they are exactly equal then, though they would be if the sun were only obliging enough to stay on the equator when it reached it. As a matter of fact, however, the sun's motion north or south when crossing the equator is more rapid than in any other part of his path, and so the days and nights are not quite equal at the equinoxes. Take the equinoxes this year as examples: At New York, on March 20, the sun rises at 3 minutes past 6 A.M., and sets at 12 minutes past 6 P.M., making the day 12 hours and 9 minutes long. Since the sun sets on the 20th at 6:12, and rises on the morning of the 21st at 6:02, the night of the 20th is only 11 hours and 50 minutes long, or 19 minutes shorter than the day. Again, on September 22, the sun rises at 5:48 A.M. and sets at 5:57 P.M., the day being 12 hours and 9 minutes long. But as the sun rises at 5:49 A.M. on the 23d, the night of the 22d is only 11 hours and 52 minutes long, or 17 minutes shorter than the day.

The place in which the sun crosses the equator in Spring is also known as the first point of *Aries*. *Aries* is the constellation of the Ram. But when on the 20th of March this year the sun crosses the equator, it will be in the constellation of The Fishes, almost in a direct line beneath the Alpherat and Algenib in the square of Pegasus. Why do astronomers call this place, then, the first point of Aries? Well, the two points in which the sun crosses the equator are not stationary, but are changing every year. The earth is like a big top spinning around on its axis at a great rate, and at the same time running around the sun along that tilted hoop called the ecliptic. But the top isn't quite steady; as the boys would say, it wobbles a little bit, and the effect of the wobbling is to make the equinoctial points go backward a trifle every year. This going backward—or from east to west—of these points on the equator is called the precession of the equinoxes. But some bright reader will say: "Precession means going before, and these equinoctial points go backward! Why not call it retrogression of the equinoxes?" Well, perhaps that would be a better title; but "precession" here means that the equinox of to-day "precedes" that of to-morrow; that of to-morrow "precedes" or is east of the place of the equinox the next day, and so on. This change of place is constantly going on, but so slowly that it only amounts to 50¼ minutes of arc in a year—a quantity so small that it will take nearly 26,000 years for these points to go entirely round the equator.

The man who first found out about this precession of the equinoxes did it a very long time ago. His name was Hipparchus. He was a disciple of the great school of Alexandria, and lived about 140 years before Christ. And he found it out in this way: Some 170 years before his time another astronomer named Timocharis had calculated the distance of

INTERIOR COURTYARD OF A HOUSE IN TEHERAN, PERSIA.

Spica, in the Virgin, from the sun at the time of the autumnal equinox. Hipparchus also measured this distance and found it to be greater than Timocharis had made it. The difference between the two measurements was too large to lead him to suppose that Timocharis had made a mistake, and he was thus forced to the conclusion that the sun and Spica were really further apart than they were a hundred and seventy years before. And he found further that by dividing this difference by the number of years which had passed since the first measurement was made, the annual precession was 49 minutes—which was only a very little wrong. Now, in the days of Hipparchus the sun really was just entering the Ram at the spring equinox, which was then, therefore, the first point of Aries. In the 2,000 years since this point has gone westward nearly 28 degrees, which brings it into the constellation of The Fishes; but the old name has not been changed.

"Hipparchus was a very clever astronomer," says the writer. "It would take too much room to tell all about him, but I may mention one other good thing he did: he made a catalogue of the principal stars—the first of its kind—and calculated their positions. This passed three hundred years later into the hands of another old astronomer named Ptolemy, who made a better catalogue, which has been very valuable in enabling modern astronomers to find out the changes which have taken place in the apparent places of the stars during the past two thousand years."

The first point of Aries is important, because it is the point from which the right ascensions of all the heavenly bodies are reckoned. To mark places on the earth we speak of their longitude and latitude. The position of a star is expressed by its right ascension and declination. Declination means distance north or south of the equator. Right ascension is the distance from the first point of Aries measured on the equator, always to the east, and is usually stated in time, one hour being equal to 15 degrees of arc. In consequence of this going backward of the equinoxes, the right ascensions of all the stars are constantly increasing, and will of course go on increasing till the first point gets back to Aries, or right ascensions are reckoned from a fixed point.

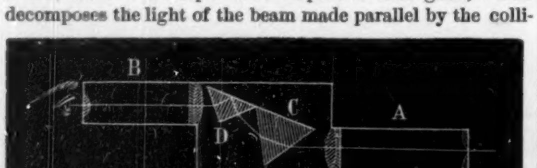
Orion is still the most conspicuous constellation, and may be found in the southwest soon after dark, with Sirius in the Great Dog nearly south. Other prominent stars visible on fine evenings are Mirfak in *Perseus*, Alcyone in the *Pleiades*, Aldebaran in the Bull, Capella in the Wagoner, Procyon in the Little Dog, Castor and Pollux in the Twins, Regulus in the Lion, Arcturus in the Hunter, and Spica in the Virgin. The moon is in conjunction with Jupiter and Mars on the 7th, and will occult one or two of the smaller stars in the *Pleiades* a little after 9 o'clock (Washington time) on the evening of the 19th.

[For the Scientific American.]

NEW SPECTROSCOPE FOR DIRECT VISION.

BY PROFESSOR A. RICCO.

This instrument consists of the following parts: A is a collimator, in which the distance of the slot for the admission of light to the achromatic lens is equal to the focal distance of the latter. C is a prism of dispersive flint glass, which decomposes the light of the beam made parallel by the colli-



mator. D is a prism for total reflection, which sends the decomposed light into the telescope, B, parallel to the collimator, A. If the field of view of the telescope will not hold the whole of the spectrum, the prism, D, is made to turn about an axis passing through the middle of the hypothenuse of its base by means of an external lever. By this means the different parts of the spectrum will be successively reflected into the telescope.

On account of its simplicity, this spectroscope is very easily constructed; and by reason of the shortness of the path which the light passes over in the glass, the loss of light is less than that which takes place in a five-prism Amici spectroscope for direct vision.

Modena, Italy.

Metallotherapy—Another Deception.

When the blue glass believers become tired of their hobby, as many of them doubtless already have of mesmerism and "movement," "grape," "will," and other "cures," which from time to time have furnished sensations for the gullible or held out vain hope to the afflicted, they will find a new field for their credulity in the metal cure lately invented in France, and which, according to one of our best French contemporaries, is working miracles. Here are some examples: A young woman was totally paralyzed over her right side. Her body was utterly devoid of feeling; and a sharp needle thrust in her body attracted no notice. Dr. Burg simply gave her a cylinder of gold to hold in the hand, she being blindfolded. In fifteen minutes, she felt a pin prick, then recognized the touch of a plurality of objects, and regained perfect sensibility. Another patient had her left side paralyzed. This called for a copper cylinder, whereupon she too was cured. Then a venerable lady, whose jaw was in a similar unfortunate condition, was cured by a lump of iron under her tongue and a bandage of iron plates on her head. It should be observed that interchanging metals upon these people did not produce good results. Their "systems" required the metals named, and no others.

Cause, of course, electricity, it being the fashion to use that much-misused word to explain anything which is not readily comprehended, from blue glass radiations to love. "Electric homœopathy" our contemporary calls this latest deception, while devoting several columns to its grave consideration.

The Obnoxious Franking Privilege Again.

The Sundry Civil Appropriation bill, which was hurried through Congress during the closing hours of the late session, has been made the means of putting through a measure, tacked on as an amendment, which is meeting with the wholesale reprobation that it deserves. It is a resurrection of about the worst feature in the hitherto defunct franking privilege—namely, that of allowing members of Congress to send public documents free through the mails. Luckily the period fixed by law wherein the postal service of the country can thus be turned into an express agency for Congressmen expires on January 1 next; so that, even if the measure be not repealed before that date, public opinion concerning it is sufficiently strong to prevent its subsequent renewal.

We have frequently pointed out how great an imposition on the government any such privilege as this is. The mere sending of Congressmen's letters is in itself no particular burden to the mails; but when it comes to forwarding tons of electioneering documents already printed, and now distributed at the cost of the people, or private packages, or even wash clothes (as used to be the case), and the brunt of all to be borne by a service already working under a deficit, the practice degenerates into an abuse, and there is no reason for its existence. Now, we suppose, the average member will flood his constituents with Patent Office reports and copies of his speeches in lavish profusion, and in marked contrast to his careful distribution of such favors when he had to pay the postage. Government presses will accordingly be kept running, and the people will lose, not only the member's small contribution to post office expenses, but will pay for the production and transportation of some thousands more useless books, which will follow their usual short circuit from the press to the paper maker.

And that is not all; pension agents, land agents, patent agents, and others doing business in Washington, will probably avail themselves of some friendly member's stamp or signature in mailing broadcast their circulars, etc. This was done before, and human nature has not changed.

Blue Glass in a Nut Shell.

General Pleasonton's blue glass theory is assailed by the SCIENTIFIC AMERICAN. His idea that electricity is generated by the passage of light through the glass is declared to be absurd. Nor have colored rays any beneficial effect on life, the reverse rather being the truth, as a pure, white light is best. The only good that can possibly come of blue glass is in its use as a shade for decreasing the intensity of solar light.—*New York Sun.*

PUBLISHERS' NOTICE.

New subscriptions to the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT will, for the present, be entered upon our books to commence with the year, and the back numbers will be sent to each new subscriber unless a request to the contrary accompanies the order.

Instead of a notice being printed on the wrapper, announcing that a subscription is about to end, the time of expiration is now denoted in the printed address each week.

IN the article on the oleo-margarin industry in our last issue, the statement that "mixed fat of all kinds" is used should read "mixed beef fat"—this being the only variety employed at the factory described.

Inventions Patented in England by Americans.

From February 3 to February 19, 1877, inclusive.

ARTILLERY GAME.—W. Rose, New York city.
CIGAR MACHINERY.—J. F. Fygh, Philadelphia, Pa.
CIGAR-MAKING MACHINE.—J. S. Winsor, Providence, R. I.
CUTTING PIPES, ETC.—A. C. Wood, Syracuse, N. Y.
DRESSING MILLSTONES.—W. Griscom, Pottsville, Pa.
FIRE ARM, ETC.—E. T. Starr, New York city.
FRICTION COUPLING, ETC.—A. K. Rider, Walton, N. Y.
GAS STOVE, ETC.—E. B. Cox, Brooklyn, N. Y.
LOCK STITCH SEWING MACHINE.—C. F. Hollis, Boston, Mass.
MAKING SAWS, ETC.—G. F. Simonds, Fitchburg, Mass.
PADDLE WHEEL.—W. C. Thompson, Tipton, Tenn.
PAPER PULP BOX, ETC.—S. Wheeler *et al.*, Albany, N. Y.
PARING APPLES, ETC.—G. Bergner, Washington, Mo.
REFRIGERATOR, ETC.—C. L. Riker *et al.*, New York city.
ROTARY ENGINE.—J. C. Thomas, Carlinsville, Ill.
SCHOOL SLATE, ETC.—J. W. Hyatt *et al.*, Newark, N. J.
SEWING MACHINE.—C. H. Willcox, New York city.
SHUTTLE.—W. Beatty *et al.*, Gray, Me.
SPINNING FRAME.—G. Draper *et al.*, Hopedale, Mass.
YARN-WINDING REGULATOR.—S. Jackson, Lawrence, Mass.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE GEARING.

David G. Wyeth, New Way, O.—The object of this invention is to provide a vehicle gearing in which a reach, fifth wheel, and ordinary form of bolster are dispensed with. The springs are coupled in pairs, and arranged in a triangular relation to the rear axle. The rear clips and front bearings of the springs are also constructed in a peculiar manner. For particulars, see patent.

IMPROVED MACHINE FOR JOINTING STAVES.

Edmund W. Gillman, Long Island City, N. Y.—In this device two rotary concave cutter disks are arranged facing each other, upon a single shaft, each disk being provided with knives arranged tangential to a circle of small diameter described from the center of the disk. A casing surrounds each disk, which is connected with an exhaust fan for removing the shavings. Adjustable guide plates are attached to the side of the casing for supporting the stave, and there is a pivoted frame for carrying the stave centering and clamping apparatus. The machine includes a device for centering the staves, and for clamping them while being jointed; and also an adjusting device, by means of which the ends of the staves may be narrowed more proportionately in wide staves than in narrower ones; and means for inclining the stave in opposite direction to give its edges the proper bevel.

IMPROVED FLOOR CLAMP.

William H. Tarrant, Eau Claire, Wis.—This clamp may be used for laying single or double flooring. It consists of an eccentric cam and lever that operate jointly a sliding bar for pushing the flooring board and spring-acted and serrated cam levers that bind on the joists for securing the clamp frame rigidly in position during work.

IMPROVED SNOW GUARD FOR ROOFS.

George F. Folsom, Boston Highlands, Mass.—This consists of a wire bent at right angles at one end and sharpened, so as to be readily driven into the roof boards. At the other end it is bent in the opposite direction, and formed into a loop of peculiar shape, which projects upward from the roof, and is provided with a tongue which is capable of retaining a plate of metal, which will retain the snow until it melts, thereby preventing the sliding of large quantities of snow in a mass from the roof.

IMPROVED GANG SAW MILL.

Dudley J. Marston, Amesbury, Mass.—This relates to that class of gang saw mills that employ a series of vertically reciprocating saws for cutting a number of boards simultaneously from a log. The advantages claimed are, that long and slender logs may be sawed without difficulty, as the force is exerted equally from above and below. The gates, having oppositely arranged cranks, counterbalance each other, so that jarring is avoided, and the speed may be increased, and the strain on the frame being lessened, it may be made lighter than the frames of ordinary mills.

IMPROVED MACHINE FOR JOINTING STAVES.

Joseph S. Milton, Bardstown, Ky.—This consists of a swinging stave-supporting or bed frame, with ratchet shaped guides, operated by a hand lever, and swinging in guide grooves of the main frame. The stave is pressed against curved adjustable seats and held in bulged shape by a cam lever and spring ratchet, for being jointed by a plane guided along the table of the machine.

NEW TEXTILE INVENTION.

SOFTENING AND CLEANSING ANIMAL AND VEGETABLE FIBRE.

William Maynard, New York city.—This invention relates to the use of detergents previous to bleaching, by which cotton, silk, wool, and grasses (such as hemp, flax, etc.) may be softened, decolorized, and cleansed, without boiling and with greater economy of time, labor, and materials. The process consists in the use of sulphuric acid, hydrated, mixed with a centralizing proportion of an alkali, but principally sal soda, which mixture is used instead of a solution of the crystallized sulphite salt, and possesses peculiar advantages over the use of the latter in that it obviates the time, labor, and expense of crystallization, is much more effective in its actions, does not injuriously affect the fiber, and is not subject to the deterioration incident to the use of the crystallized sulphites, which, when kept, rapidly oxidize and pass into the sulphates.

NEW MISCELLANEOUS INVENTIONS.

PREVENTING ACCUMULATION OF CARBON IN RETORTS.

Watson Karr, Frostburg, Md.—The process consists in using a small quantity of semi-bituminous coal with the ordinary bituminous or soft coal in the retort. The hydrogen gas produced from the semi-bituminous coal combines with the carbon from the bituminous coal which would otherwise be deposited upon the roof of the retort. The process saves the labor and time required for removing the carbon formations from the retort in the usual way, and likewise avoids the consequent injury to the retort itself, so that its durability is greatly increased.

IMPROVED BALE BAND TIGHTENER.

John L. Sheppard, Charleston, S. C.—The object of this invention is to provide an improved device or apparatus for bringing together the ends of cotton bale bands and taking up the slack while the bales are in the press. The same consists in vertical sliding bars, attracted respectively to the front side of the platen and bed of the press, and provided with slots, or otherwise so constructed as to enable them to clutch the ends of the band, so that when they are slided towards each other the band will be tightened and the slack taken up.

IMPROVED STOCKING SUPPORTER.

E. Louise Demorest and Thomas W. G. Cook, New York city, assignors to W. Jennings Demorest, of same place.—This consists in the combination of a clasp pin attached to the ends of an elastic strap by means of clips, and a combined clasp pin and buckle that receives the elastic strap, which is double. The clasp pins at the lower ends of the elastic strap are fastened into the stocking, and the clasp pin that is attached to the buckle is fastened to the under garments.

IMPROVED TOY WHIRLIGIG.

Charles E. Steller, Milwaukee, Wis.—This toy is so constructed as to give a rapid rotary motion, first in one direction and then in the other, to objects placed upon the revolving table or disks, to cause said objects to represent various beautiful and fanciful forms.

IMPROVED VETERINARY SURGICAL INSTRUMENT.

Lewis Woods Hamilton, Pendleton, Oregon.—This instrument is specially adapted for use in castrating animals. It consists of nippers having cup shaped jaws, and cutting blades which are formed on the opposite end of the same levers. Said levers are pivoted together intermediate of the nippers and shears, and the shanks of the latter are provided with a finger-loop and guard.

IMPROVED SAFETY GUARD OR COCKEYE FOR HARNESS.

Fayette W. Knapp and Christopher Schallhorn, Fiddletown, Cal.—This consists in a peculiar construction of the cockeye which connects the trace with the single-tree. The eye which embraces the single-tree is swiveled to the yoke, which is attached to the trace, and is provided with a spring-actuated follower, between which and the end of the eye the hook which is upon the end of the single-tree is embraced. The invention was described and illustrated on p. 118, vol. 36.

IMPROVED FLY BRUSH.

Daniel H. Mowen, Greencastle, Pa.—This consists in the arrangement of a vertical shaft carrying a horizontal brush arm, a lever for moving the same, and a clamp for attaching it to a table or chair. The said shaft is provided with a spring for returning it to its normal position after it is moved by the lever. There is also a new adjusting device, by which the brush arm may be readily adjusted to any height on the vertical shaft, and by which the said arm may be made to project more or less from the vertical shaft.

IMPROVED GAS TORCH.

Albert R. Weiss, Brooklyn, N. Y.—This consists of a gas-lighting torch worked by a fulminate ribbon, whose pellets are fed and ignited by a suitable mechanism. The latter consists of a sliding sectional piston rod, operated from a trigger of the handle guided in a curved tube, and reset by a spring of the feeding device.

IMPROVED REIN SUPPORT.

Joseph L. Ryder, Islesborough, Me.—This device is made of a single piece of metal bent to form a central guide piece, eyes, and guard tongues. It prevents the reins getting entangled under the whiffletrees, or under the horse's tail.

IMPROVED MIDDLINGS SEPARATOR.

Peter Muller, St. Charles, Mo.—This consists in suspending the frame of a middlings purifier by straps, and providing it with a cam wheel, pawl, shaft, and springs, arranged to reciprocate and jar the frame transversely to the flow of the material.

IMPROVED ELECTRIC LIGHTING APPARATUS FOR LAMPS.

Prof. William H. Zimmerman, Chestertown, Md.—This is a novel construction of self-lighting lamp, based upon the general principle of the employment of a hydrogen gas generator, together with a galvanic battery, in which the battery current heats a platinum wire red hot to ignite the jet of hydrogen, the flame of which latter impinges against and ignites the wick of the lamp. The invention consists, mainly, in locating the gas generator and the battery in twin supporting sockets attached to the brachial slide carrying the lamp, and in rendering the various vessels to be filled capable of independent support in upright position while being filled; in addition to which, the invention further consists in novel means for simultaneously bringing into operation both the gas generating apparatus and the battery, and instantly effecting the generation of gas, the flow of the electric current, and the lighting of the lamp. The self-lighting devices may be applied with slight modifications to all forms of lamps as well as to gas brackets.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HORSESHOE MACHINE.

John W. Chewning, Jr., Shadwell Depot, Va.—The present invention is an improvement upon that for which letters patent of the United States were granted to the same party August 26, 1876 (No. 181,641). The improvement relates to the construction of the contact surfaces of the swaging die and the combined former and ejector; also to the mechanism for reciprocating the swaging die.

IMPROVED CHAIN PROPELLER FOR VESSELS.

William B. Whiting, Milwaukee, Wis.—This invention is an improvement in that class of chain propellers in which the boat is bisected by a central longitudinal opening in which the chain propeller is arranged. The novelty consists partly in the improved construction of the propeller, designed with a view to strength and smoothness of operation; and also in arranging the endless chain propeller about an inclined compartment connecting the two portions of the boat upon opposite sides of the central channel, which compartment rises toward the stern so as to secure the double result of facilitating the return of the paddles to the forward end of the boat upon the inclined deck railway, as well as the withdrawal of the paddles vertically from the water, which obviates the carrying of "dead water."

IMPROVED QUILTING ATTACHMENT FOR SEWING MACHINES.

John Douglass, Millport, Mo.—The quilting frame is attached to and pendant from a traveling carriage, which is supported upon an extensible horizontal beam or frame, in such manner as adapts it to be used in connection with a sewing machine. The quilting frame is moved back and forth to carry the quilt under the needle and return, and may be hung up out of the way when not required for use. The beam on which the carriage runs may be easily taken down when required.

IMPROVED APPARATUS FOR CONVERTING MOTION.

Peter Gregersen, Wauzeka, Wis.—This is an apparatus for converting reciprocating motion to continuous rotary motion; and it consists in the combination of movable racks with a sliding frame that is attached to the piston rod of an engine. The device also consists in a mutilated pinion that meshes with the movable racks, and is provided with a double cam, by which the motion of the shaft rotated by the said racks is reversed.

IMPROVED MACHINE FOR SHEARING SHEET METAL.

George Summers, Niles, O.—Threaded rods are provided upon which the feet are formed. These feet are fastened to the fixed jaw of the shears by means of bolts, and project therefrom at right angles. Guide plates are fitted loosely to the rods, and are held in place by means of nuts. Several sets of guide plates may be provided, that increase in height as they are placed farther from the blade of the shears, so that a number of widths may be cut without readjusting the gage.

IMPROVED EARTH AUGER.

James McCullough, Pensacola, Fla.—By turning the center shaft in one direction, the auger is opened for work, taking in the sand, earth, and water, and retaining the same, by turning the shaft in opposite direction and closing the openings of the auger by a valve. The auger is then raised for being emptied, the center shaft being attached to the auger, to prevent displacement of the valve in vertical direction by a collar, keyed to the shaft below the yoke.

IMPROVED EARTH AUGER.

Edward Cox and Henry Cox, East St. Louis, Ill.—This consists of a box auger attached, by a yoke, to a vertical shaft, at the upper end of which another yoke is attached that is made to revolve by bevel gearing. The upper yoke is provided with a horizontal shaft, having at its outer end a pinion that travels upon a series of cogs formed at the edge of the circular openings in which the yoke is suspended. An endless chain, carrying buckets, passes over a pulley on the horizontal shaft and around a pulley in the yoke that supports the auger. The whole is supported by a derrick, which is provided with a windlass for raising and lowering.

IMPROVED COTTON CLEANER.

James A. Bowers and Milton Adar, Princeton, Ark.—This consists of a slotted and ribbed stationary concave and a revolving cylinder with beaters, combined with a feeding and discharging case, in which the cotton feeds from a hopper at the top and escapes at the side, while the dirt and trash which are beaten out of the cotton by the beater cylinder and ribbed concave fall through the spaces and escape.

IMPROVED WATER ELEVATOR.

John F. Long, Bridgewater, Va.—This consists in the arrangement of two pulleys, one placed in a curb over a well, and the other at the bottom of the well, over which runs an endless belt carrying buckets that dip up water and deliver it to the spout in the curb.

IMPROVED WATER ELEVATOR.

Thomas J. Reid, Lexington, Ind., assignor to himself and John Malick, of same place.—This relates to that class of elevators that employ a windlass and bucket for raising water. The windlass has two drums, of different diameter, journaled in the upper portion of the curb. Upon the larger drum a rope is wound, by which the bucket is raised or lowered, and upon the smaller drum a strap is wound in a contrary direction, which is attached to a curved lever, by which the elevator is operated. There is also an arrangement of wire guides for the buckets, that extend from the top to the bottom of the well. A slide runs upon the said wires, to which the bucket is hinged, and a catch receives and retains the slide when the water is emptied from the bucket.

IMPROVED STEAM GAGE.

Frederick H. McIntosh, Atlantic, Iowa.—This invention consists of a steam gage, whose pressure-indicating spring rod is guided in a screw sleeve at the top, which screw adjusts the tension of the spring until indicating the correct pressure. A link is screwed on to the threaded end of the pressure rod to apply the scales to the gage.

IMPROVED WATER WHEEL.

Elisha B. Shattuck and Isaac Stahlman, Mount Pleasant, Mich.—In this device it is claimed that increased power is obtained, the water freely discharged, and a larger percentage of the water power utilized. The invention consists of a double wheel, in which the buckets of the upper wheel connect with an inner tube and spiral buckets around the shaft, while the lower wheel connects with an outer cylinder or tube. The wheel is concaved or dishing, and provided with vent holes at the top to accelerate the discharge of the water.

IMPROVED PILE DRIVER.

John Gregg, Riverton, Iowa, assignor to himself and James Miller, of same place.—When this device is used as a pile driver, guy-ropes are fixed in eyes attached to the ends of the bolt, on which the pulley sheave works, and the derrick is inclined, so that its top is directly over the place when the pile is to be driven. A clamp is then loosened, and guides are allowed to swing into a vertical position, where they are secured by the clamp engaging braces. The weight is raised by turning the windlass by means of a lever, a rope being attached to it, and running over the sheave, and attached to the hammer moving in the guides.

IMPROVED METHOD OF PROPELLING BOATS.

Albert Belz, Appleton, Wis.—The paddle wheel shaft is provided with ordinary paddle wheels. A spur wheel, which is keyed to the shaft and takes its power from a similar wheel, which is fixed upon the shaft. Cranks are placed on opposite ends of the shaft, and are worked by hand levers. The whole apparatus may be easily detached from the boat when desired.

IMPROVED BALANCED VALVE FOR STEAM ENGINE.

William Jackson, Millerstown, Pa.—This consists of a valve the back of which is beveled, and whose central or exhaust space extends to the rear in a beveled cover placed at the back of the valve, between which and the valve seat the valve moves. The whole is inclosed in the steam chest, and all of the exposed sides of the valve are subjected to the same pressure, so that the valve is balanced, and little power is required to move it.

IMPROVED ROTARY ENGINE.

John C. Thomas, Carlinville, Ill.—The wheel or disk within the casing has deep transverse grooves in which radial pistons work, the rods of which pass through stuffing boxes in the wheel. The rods are attached to hollow boxes in which are springs which act upon bars. Said bars pass through slots in the boxes and through slots in the radial bars or spokes of the wheel and connect.

IMPROVED HEMMER FOR SEWING MACHINE.

Charles L. Goethals, Los Angeles, Cal.—This is an improved adjustable hemmer for sewing machines, by which folds of different widths may be hemmed and the fabric fed in regular manner to the needle after being started. The invention consists of a base part, with sliding folding part, that folds and feeds the fabric to the needle, and a pivoted guide piece, that regulates the folding of the fabric.

IMPROVED PUMP.

Swan Petersen, Knoxville, Ill.—The lower and the upper pump stock are coupled together by a tube joint. A rim extends around the tube intermediately between the ends of the pump stocks, which are tightly seated against the rim by packing rims. The strong and rigid connection of the pump stocks is obtained by projecting metallic lugs, secured by bands extending around the ends of the pump stocks. The lower pump stock is secured to the walls of the well by a brace, which is rigidly wedged in place. The convenience of releasing the brace and taking out the lower pump stock for repairs, as well as the reliable and effective working of the pump when properly coupled at the tube joint, furnishes a pump of substantial, durable, and convenient construction.

IMPROVED ROTARY ENGINE.

Hodgen I. Willson, Harrisville, Tex., assignor to himself and L. J. Russell, of same place.—The operation of this rotary engine is as follows: Steam passes through a passage in a rocking valve on the upper side of the cylinder, and through one or two passages in said cylinder into the steam chest; thence through a port in a side valve, and through a passage in a guide, and into the cylinder by way of a passage in the abutment. When the piston has moved through a half revolution, a cam quickly shifts the rocking valve, so that steam is admitted to the other of the two passages. The steam acts upon the piston, shifting the abutment, and admitting steam to the cylinder, forcing the piston through the remainder of the stroke. While this takes place the steam from the first passage is allowed to pass into the exhaust.

IMPROVED WATER WHEEL.

Nelson L. Greene, Edmeston, N. Y.—By new devices in this wheel, a body of water of varying cross section may be thrown without obstruction or diminution of power on the wheel. The escape of water at the top of the casing is also prevented, and a full utilization of the reaction of the water at the lower part of the wheel is claimed to be obtained.

IMPROVED TRUSS BRIDGE.

Lyman W. Densmore, St. Joseph, Mo.—The principal novel features of this bridge are: First, forming the truss chord of metallic rods having their ends extended past each other and through the girders or couplings, and fastening them upon the opposite sides of said girders or couplings by means of nuts; the chord rods being increased in number toward the center, but always arranged about a common center of tension; and secondly, the fastening of one of the tension rods in each panel, whose strut carries a cumulative horizontal thrust to an independent angle block carrying said strut; and thirdly, the particular arrangement of a detachable girder beneath the couplings.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN HARVESTER.

James Plenkharp, Columbus, O.—The corn stalks are severed close to the ground and carried back on to a platform by means of a rotating-armed shaft, and a vibrating carrier provided with hooks or curved arms. The platform is made in two parts, of elliptical form, each of which turns horizontally, and tilts to discharge the "shock" upon the ground. The platform is tilted by a suitable device under the control of the driver.

IMPROVED SEED PLANTER.

James H. Sale, Boydsville, Ky.—This invention belongs to that class of seed planters in which a given quantity of seed are lifted from the hopper by means of a pivoted reciprocating seed cup, and are dumped into a pipe or chute leading to the furrow. The improvements consist, mainly, in the particular construction and arrangement of the feed bars, hollowed out at their upper ends to form seed cups, which bars are pivoted below to the cranks of the main driving axle and extend upwardly through openings in the bottom of the seed box, in which openings they loosely slide, and about which point the feed bars also oscillate as a fulcrum from the revolution of the cranks carrying the bars below, so that the upper ends of the bars, provided with the feed cups, have a compound motion which causes them alternately to rise and move forward to dump the seed, and then recede toward the center of the box and descend to be filled again.

IMPROVED RECIPROCATING CHURN.

John Henry Sheffer, Cairo, Ky.—This relates to gearing for converting the rotary motion of a hand crank into the reciprocating motion required for driving the dasher. It consists in a crank disk that is attached to a shaft that is journaled in a standard attached to the churn cover, and driven by spur gearing turned by hand power. There is also a slotted cross head that is driven by the crank, and is connected with a jointed dasher rod.

IMPROVED HARROW.

Charles Keehner, Roseville Junction, Cal.—The new feature here is a harrow section formed of converging rods connected by cross rods, the other rods having their nearer ends hooked, and the inner having their farther ends hooked. The middle rod is provided with a hook at one and an eye at the other end, so that by alternately reversing the sections they may be connected at the sides as well as in alignment.

IMPROVED CORN PLANTER.

August. J. Hintz, Lemont, Ill.—In using this planter, the jaws are thrust into the soil up to a stop attached to a stationary jaw. The upper end of the planter is then carried forward, which swings the stationary jaw backward, allowing the seed to drop into the soil, and, at the same time, loosening the soil, so that it will fall into the hole formed by the jaws as the same are withdrawn. As the jaws are withdrawn from the soil a spring closes the said jaws, ready to be again thrust into the soil, and, at the same time, draws forward an arm, bringing the dropping hole within the body, to be again filled with seed.

IMPROVED CORN PLANTER.

Jesse G. Stokesbary and John H. Stokesbary, Millersburg, Iowa.—This corn planter is so constructed as to drop the seed automatically as the machine is drawn forward. It is easily controlled, and enables the hills to be planted in accurate check row.

IMPROVED HAY GATHERER.

Harlin Butner and James J. Ray, Clarence, Mo.—This is a rake for collecting the hay and drawing it to the stack. It is so constructed that the weight of the load will raise the points of the teeth from the ground, so that they will not catch, and so that it may be readily withdrawn from the load when desired.

IMPROVED SHOVEL PLOW.

Thomas H. C. Dow, Tampico, Ill.—This implement is so constructed that it may be adjusted for use as an ordinary shovel plow, or turned toward either side to form a right or left hand plow, as the particular work to be done may require.

IMPROVED COTTON PLANTER AND FERTILIZER DISTRIBUTER.

Joseph A. Shine, Mount Olive, N. C.—This machine is so constructed as to open a furrow, distribute cotton seed and guano into it, and cover the seed. It includes a new construction of the hopper and attached mechanism.

IMPROVED FARM FENCE.

Charles Cremer, Red Bluff, Cal.—This fence is made without posts or nails, and is so constructed that it may be used as a stock fence, as a protector for young hedges, and as a sheep shed. It is not liable to be pushed or blown over. To the notched outer edges of the supporters the side boards are attached. Said boards are beveled at their ends to overlap each other edgewise in said notches, and are secured to each other and to said supporters by wires.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.—It consists of a chair having the rear legs and back made in one piece with a seat hinged to the same at the rear and free to fold upwardly at its front; in connection with which elements are arranged a set of front legs with tenons at their upper ends which enter mortises in the chair seat, the said front legs being connected with the seat and back by means of side braces pivoted to the front legs, the middle part of the seat, and the back of the chair, and provided with an upwardly folding toggle joint whereby the parts of the chair may be folded compactly, and in such manner as to stand alone upon its four legs.

IMPROVED FRUIT JAR.

Adam Dicker, Middletown, O.—This is a fruit jar composed of black opaque glass, which excludes light from its interior. It combines all of the advantages of transparent glass, metal, and earthenware, with none of their disadvantages—*i. e.*, it prevents the fading and deleterious effect of light upon the fruit incident to transparent jars, obviates the corrosive action and metallic taste produced by the acids of the fruit upon metal cans, is free from the clumsiness of earthenware jars, and the objectionable action of the acids upon the glaze on the one hand, or the difficulty of removing the germs of ferment on the other when left porous.

IMPROVED BUTTER DISH.

Westel E. Hawkins, Wallingford, Conn., assignor to Simpson, Hall, Miller & Co., of same place.—In this butter dish the cover of metal is made in two parts, pivoted at their angles to the opposite sides of the body of said dish, so that they may be turned down upon the outside of said body. Segmental gear wheels at the angles of the parts of the cover cause said parts to move together upon their pivots. Suitable devices are provided for fastening the cover in desired position.

IMPROVED BLANKET.

Nathaniel Wickliffe, Waterproof, La.—This consists of a couple of light blankets of wool with a lining between or outside of them of paper, laid on a sheet of gauze adapted to strengthen the paper, to prevent it from tearing by the handling of the blankets. The paper and the cloth layers are suitably fastened together detachably by buttons, to take them apart to remove the paper for washing the cloth. The paper, being of such close texture as to prevent the passage or air, makes the blanket much warmer for a given weight of material.

IMPROVED WASHBOARD.

Westly Todd, Wauseon, O., assignor to himself and H. H. Williams, of same place.—The object here is to improve the construction of the washboard for which letters patent were granted to same inventor July 18, 1876, so as make it stronger and more durable without increasing the cost of manufacture. The improvement consists in short parallel corrugations formed along the side edges of the zinc facing, between or within the main corrugations.

IMPROVED ROCKING CHAIR.

William Shaub, Nashville, Tenn.—This consists of a rocking swing, made of round rockers secured centrally to the posts of the seats, and at the ends to the extended foot and seat rests. The seat rests are braced by interior strengthening pieces. The swing cannot upset, and is readily portable from place to place.

IMPROVED WASHING MACHINE.

John W. Modlin, Albion, Iowa, assignor to himself and Simon C. Gillespie, of same place.—By means of a lever, a corrugated rubber is caused to work over a concave bed of rollers. By suitable construction the rubber accommodates itself to the thickness of clothes beneath it.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

H. B., Jr., will find a good recipe for aquarium cement on p. 202, vol. 28.—C. R. is informed that the apparent spontaneous cracking of glass tumblers is by no means an uncommon occurrence.—P. B. B. will find directions for brazing band saws on p. 194, vol. 31.—C. H. B. will find directions for removing inkstains from clothing on p. 410, vol. 32. For polishing castings, see p. 57, vol. 34.—F. B. S. does not send data enough as to his engine. He will find a formula for ascertaining the horse power on p. 33, vol. 33. For a rule for calculating the dimensions of a flywheel, see p. 251, vol. 32.—J. P. N. will find a recipe for prepared glue on p. 43, vol. 32. For a recipe for mucilage, see p. 27, vol. 34.—R. P. C. is informed that the only non-conductor of magnetism is a sufficient interval of space.—E. G. will find an explanation of horse power on p. 33, vol. 33.—A. J. will find something on tempering chisels, etc., on p. 220, vol. 31.—H. L. H. should address a pump manufacturer.—H. H. will find directions for making shoe polish on p. 107, vol. 36. To season timber of all kinds, follow the directions on p. 58, vol. 32.—F. C. will find a formula for the lifting power of coal gas on p. 65, vol. 32.—C. H. B. will find directions for removing inkstains on p. 410, vol. 32. Brass castings can be polished by following the directions on p. 57, vol. 34. Steel can be etched by the process described on p. 250, vol. 27.—F. J. S. should send us a sample of the efflorescence on the ash heap.—D. W. will find a description of making gas with a hydrocarbon fluid on p. 65, vol. 32.—R. W. K. will find answers to his queries as to ice boats in No. 68 SCIENTIFIC AMERICAN SUPPLEMENT.—U. D. M. is informed that oxychloride of zinc may be used to cement silica together; but we do not think he will succeed very well with the material of which he sent us a sample.—J. C. B. can solder brass by the process described on p. 251, vol. 28. To mend rubber boots, follow the instructions given on p. 203, vol 30.—A. L. F. will find on p. 119, vol. 28, a recipe for a cement for mending leather shoes.—C. A. D. will find a recipe for red fire on p. 171, vol. 36.—J. D. will find directions for fireproofing clothing on p. 282, vol. 32.—A. D. A. will find directions for mounting chromos on p. 91, vol. 31. This also answers T. S. R.—G. K., who asks as to the U. S. Coast Survey, should sign his letters with his name and address.—E. C. S. will find on p. 319, vol. 35, a recipe for a cement wash for woodwork.—A. B. C. will find formulæ for the passage of water through pipes on p. 48, vol. 29.—W. L. B., A. J. W., W. G. L., E. K., C. F. W., J. G., N. T., W. P. B., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) T. A. D. asks: 1. What kind, diameter, and focus should a lens be for a photographic camera to take photographs $4\frac{1}{4}$ inches by $3\frac{1}{4}$ inches, principally landscape views? A. An achromatic of about $\frac{1}{2}$ inch diameter and 5 or 6 inches focus. 2. At about what distance should the lens be placed from the photographic plate? A. Where the image will be sharpest on a ground glass, placed where the photographic plate is to be. 3. If stops or diaphragms are used, what kind is necessary and where should they be placed? A. If the instrument is a double combination, the diaphragm should be placed midway between the lenses. If a single lens, place it in front. A piece of cardboard with a round hole in the center is all that is wanted. The smaller the diaphragm, the sharper the picture will be, and the longer the necessary exposure.

(2) F. I. E. says: I have several photographic lenses; and wishing to form some kind of instrument on the principle of the "Wonder" camera, so that objects and pictures may be projected on a screen without much trouble or expense, I would like to know how the glasses are arranged, and what kind of light is best? A. Your $\frac{1}{4}$ portrait lens is just what is wanted for the objective. Then, in addition to this, you need two condensing lenses, and (if gas or oil is used) a reflector behind the light, the same as in a magic lantern with the "Wonder" attachment.

(3) A. B. C. asks: Can stereoscope lenses, or the lenses of a small spyglass, be used in constructing the home-made magic lantern? A. The usual stereoscopic lenses cannot be used, because they are ground thicker on one side than the other. The lens of a small spyglass would do if not of too long focus. It will make the picture small unless the lantern is placed at some distance from the screen. A lens of about 6 inches focus is the best; and in small rooms, even shorter focus is preferable.

(4) E. J. B. asks: Will a photographic camera, with three lenses and four inches focus, do as an objective for a magic lantern? Will the "Wonder" camera as described in *Science Record* for 1875 do? Could the object glass of an opera glass be used for the purpose? A. If the photographic combination was made for a portrait camera to be used without a diaphragm, then it will answer the purpose very well. Also the opera glass objectives may be used, either singly or in combination. If one will make the picture on the screen as large as you wish, it will give you more light than the two together.

(5) J. L. K. says: I would like to make a 1 inch hole in a window pane, and have tried several ways, but broke the glass every time. How can it be done? A. Bore a hole in the center by means of a hard steel drill moistened with turpentine. Cut the circle with a good glazier's diamond guided by a small piece of copper wire centered in the hole just bored, and by means of cuts radiating from the center to the circumference divide the circle into numerous small sectors. Then, with a small piece of metal, tap the glass on the posterior side gently, following each cut throughout its extent. When this has been properly done, fasten a piece of putty over the area of the circle on the cut side of the glass; and, while holding the putty, tap the glass on the other side firmly in the center of the circle. Too much pressure on the diamond will cause it to scratch without cutting the glass.

(6) E. B. asks: 1. How shall I treat hickory to prevent its becoming powder-post, as we term it? A. The trouble is due to a diseased state of the timber, which reduces its substance to a mass of dry dust, by the decomposition of its fibers. It is caused by the growth of a species of fungus in those parts of the timber which have not been properly dried or seasoned. One of the best preventives of this disease is a solution of corrosive sublimate forced into the pores of the wood by means of an air pump. 2. When shall I cut it? A. It is best to cut the timber in the late fall or early winter.

(7) E. T. says: In speaking of leaky roofs, you say that the best job would be to put on a new tin roof in small sheets. Which kind of tin is most durable, the leaded or dark lead-colored tin or the bright light-colored tin? A. Use the best charcoal tin, which is bright-colored, and solder the joints securely.

(8) J. H. W. says: We have had an explosion in our foundry that we are not able to explain. The shop is a frame building 50 feet square. We had not made a heat for 24 days; and when we made one and proceeded to drop the bottom as usual, the instant the doors dropped we had a tremendous explosion, breaking some 250 panes of glass. It tore a door that was standing open off its hinges, and made a report that was heard at a distance, shaking the windows in houses squares away. Our shop is quite open, and two doors were standing open at the time. The prop that the cupola man used in dropping the bottom was some 10 feet long and 4 inches square. It was shivered up just as though it had been struck by lightning. There was some ice under the cupola at the time; but we threw, as we thought, sufficient sand on it to prevent the iron coming in contact with it. Are such explosions of common occurrence in foundries? A. We imagine that explosions of such violence are not usual, although those of similar kind are not uncommon, when heated iron comes in contact with moisture. Possibly some of our readers may have knowledge of explosions quite as violent as the one described above, and will favor us with descriptions.

(9) J. M. L. says: I wish to build an air stack with sufficient draught for two furnaces. Can you give me the proportion existing between area of stack at bottom and top and height, and the areas of the flues from furnaces? A. It will be sufficient to make the cross section of the stack equal to the combined cross sections of the flues. You can decrease the cross section towards the top if desirable, but there will probably be no advantage in doing so. Build the chimney at least 40 or 50 feet in height, and as much higher, up to 100 feet, as is convenient.

(10) J. J. says: 1. I wish to make a pair of sleigh runners. I have been told that the rim of a wagon wheel steamed and straightened out is very good to make them out of. But I do not know how to straighten them. Could not I get two pieces of oak, of the same thickness and width of a rim of a wheel, and bend them? A. When the wood is softened, secure it by clamps to a former. Perhaps it cannot be bent into shape all at once, but must be heated several times. 2. For a small 1 horse cutter, how far apart should the runners be at the bottom, and how far at the top? A. Distance between runners, 30 to 36 inches at top, and from 2 to 4 inches more at bottom.

(11) W. S. says: 1. I am building a ditcher for drain tile. It is to be drawn by a rope passing a sufficient number of times around a capstan to prevent its slipping, the free end being wound on a reel. The capstan is to be 18 inches in diameter, and the levers 12 feet from center of capstan to where the horses are hitched. What kind and size of rope will be best if two horses are used, and also if our horses are used? A. You can use hemp rope $1\frac{1}{4}$ inches in diameter for 2 horses, and 2 inches in diameter for 4 horses. 2. If wire rope should break, how can I mend it? A. By splicing.

(12) E. L. L. asks: Do the rubber covers upon telegraph instruments increase the sound perceptibly? A. No.

(13) C. F. A. asks: 1. What size of boiler should I use for an engine of $\frac{1}{2}$ inch bore and 4 inches stroke? A. Make one 12 inches in diameter and 20 inches high. 2. Can you recommend to me a book on the construction of the marine engine? A. We do not know any work that covers the construction of the modern marine engine. You will find much that is useful in Bourne's and Burgh's treatises.

(14) G. F. asks: 1. What I wish to know is how much power could I expect from an engine 2 x 5 inches, 60 lbs. pressure, 150 revolutions? A. From $\frac{1}{2}$ to $\frac{3}{4}$ of a horse power. 2. What size of boiler would I require if it were a plain cylinder, set in brickwork? A. Make a cylinder boiler with about 11 square feet of heating surface.

(15) W. H. K. asks: Which will bear the greater weight, applied laterally, a round or a square rod of metal or wood, of the same circumference? A. The round one.

(16) J. N. A. asks: What has been the highest result in foot lbs., by any steam engine, per 1 lb. of best coal? A. A horse power for 1·5 lbs. of coal per hour is among the best results; this corresponds to foot lbs. per pound of coal.

(17) C. P. P. says: What size of boiler would run to best advantage an engine 3 x $1\frac{1}{2}$ inches? Of what should it be made? A. You can use a vertical boiler, made of wrought iron, 10 inches in diameter and 18 inches high.

(18) C. R. W. asks: Please tell me how to calculate the number of yards of excavation in digging a pond or lake 100 feet by 80, in form an ellipse, 9 feet deep with banks sloped $1\frac{1}{2}$ feet to 1 foot of depth? A. Add together the top area, the bottom area, and the area of their mean proportional, and multiply the sum by $\frac{1}{3}$ the depth.

(19) W. L. F. says: I am making an electro-magnetic machine for medical purposes. I made a spool of wood about 5 inches long, the core of which is a hollow cylinder $\frac{3}{4}$ of an inch in diameter, containing a bundle of iron wire. For the first coil, I wound about 50 feet copper wire (insulated No. 16) around this, and separate from it. I wound about 500 feet silk insulated wire, No. 22. I connected the ends of the primary coil with 1 cell of carbon battery, but could not get a secondary current. Please tell me where the difficulty lies? A. Your arrangement will give you a secondary current by breaking and making the primary. If you require more power, increase the length of your secondary wire and use more battery.

(20) A. S. asks: I have a battery with two copper cylinders 8 inches and 3 inches in diameter, and a zinc cylinder 16 inches in diameter. What must I put in it to make it work? A. Blue vitriol and water.

(21) L. G. W. says: In making a Camacho electro-magnetic engine, can I construct the tubular magnets, and what should be the size of and length of wire used in making magnets? A. It is not worth while to make the magnets less than an inch in length. Wind each tube separately and then place one over the other. No. 23 silk covered wire will do. The turns on each tube should be in the same direction.

(22) J. S. W. asks: 1. Which will give the longest spark, an induction coil made with 2,000 feet of No. 32 wire or with 2,000 feet of No. 36? A. One with the 2,000 feet No. 36. 2. Will 4,000 feet No. 32 give a longer spark than 3,000 feet No. 36? A. No, not with same primary. 3. Which is best for the primary coil, No. 16 or No. 18 wire? A. That depends upon the size of the core and battery used. Make the resistance of primary about the same as that of the battery. 4. How long a spark ought 2,000 feet of No. 32 wire to give? A. Up to a certain limit, about 1 inch spark per mile of secondary can be obtained.

(23) A. R. asks: 1. Does the Atlantic telegraph work upon the same principle as do telegraph lines in general? It has been stated that the electricity is drawn from the cables. A. The batteries are not connected directly to the cable, but to one side of a condenser and to earth; the opposite side of condenser is connected to the cable. 2. What is the strength of the current used? A. Ten or twelve cells is about the number used to charge the condenser. 3. What is the strength at the receiving station as compared with that at the sending station? A. About 99·5 per cent after 3 seconds contact with battery.

(24) H. S. C. says: In your answer to F. H., you say that an engine generally works more economically when running at its full capacity. This is undoubtedly true of single valve engines, as a single valve cannot cut off at less than $\frac{3}{4}$ stroke without choking the exhaust and impairing its efficiency in a greater or less degree, according to the point of cut-off. But with an automatic cut-off, or even with a fixed one, I think it can be demonstrated theoretically, as it has been demonstrated practically, that there is great economy in having considerable surplus power in your engine. A. You have misunderstood our reply to F. H. The idea we intended to convey was, that under given conditions there is a point at which an engine will work most economically. This is the point at which it should be run, a point probably far within its full capacity.

(25) I. H. D. asks: 1. Why is a chamber used in a condenser for the exhaust steam to flow in? A. With a view to economy of space and efficiency of action. 2. Could not the steam be condensed in an exhaust pipe, and this pipe be connected with the air pump? A. Yes. 3. How much pressure must be given to a jet of water in the combining tube of an injector, so that it will gain velocity enough to enter a boiler, without flowing back into the overflow? A. It depends upon the proportions of the parts. As usually made, the injector will readily force water into the boiler from which it draws its supply of steam, and could be arranged so as to force against much higher pressure than that under which it was working.

(26) G. F. asks: 1. How large an engine could I supply steam to from a plain cylinder boiler, 9 feet long and 14 inches in diameter, of $\frac{1}{4}$ inch iron? A. You can use an engine of from 2 to 3 horse power. 2. Is a plain boiler safer than one with flues? A. Not necessarily.

(27) G. L. K. asks: 1. Can steam from a boiler with 60 lbs. force water into a cold boiler? A. Yes. 2. Is it possible to get a pressure in the cold boiler above the steam pressure in the steam boiler? I have seen an injector that is said to have forced water into a boiler having 80 lbs. pressure, the injector being operated from a boiler with 20 lbs. pressure. A. Yes. The philosophy of the matter is that a great deal of steam is used, and comparatively little water is forced into the boiler. It is something like a steam pump in which the water cylinder is only $\frac{1}{5}$ as large as the steam cylinder, so that the water pressure can be 5 times the steam pressure.

(28) H. C. asks: 1. What pressure will a locomotive boiler of copper plates of $\frac{1}{16}$ of an inch thick, 6 inches in diameter, double riveted, stand? A. 40 lbs. 2. How large an engine will it run with firebox 8 x 8 inches and 8 inches high, and 22 half inch tubes 12 inches long. A. Make one 2 x 3 inches. 3. Which of these two engines, 5 x 6 or $4\frac{1}{2}$ x 8 inches, is best for a boat 25 feet long and of 6 feet beam, drawing 6 inches at bow and 24 inches at stern? A. If you wish to compare them when running at the same power, we think the first is preferable on some accounts.

(29) O. A., Jr., says: 1. I have a steam engine with a plain slide valve. The cylinder is 7 inches bore by 9 inches stroke. Steam ports are $\frac{1}{4}$ by $5\frac{1}{4}$ inches, exhaust port is 1 inch by $5\frac{1}{4}$ inches. Valve travels $1\frac{1}{4}$ inch; lead of valve is about $\frac{1}{16}$ inch, lap about $\frac{1}{16}$ inch, cutting off at about $\frac{3}{4}$ stroke. Engine runs about 240 revolutions per minute with 70 lbs. steam. Can I get more power out of the engine by changing those proportions? A. We do not think, from your account, that there is any need of a change. 2. Which kind of a return flue boiler is the most economical in fuel and water: the boiler that will hold $1\frac{1}{2}$ barrel of water or the boiler that will hold $4\frac{1}{2}$ barrels, the heating surface being the same in both boilers, and each being of 10 horse power? A. We imagine the difference, if any, would be unimportant.

(30) G. W. A. says: We use 60 lbs. steam on a 12 x 20 inches engine, running three burrs. If we keep just 60 lbs., it is pretty hard work; and it seems easier to let the engine stand and generate 80 lbs. What is the cause of this? A. Generally, an increase of pressure decreases the steam used per horse power, so that although it takes a little more fuel to make 1 lb. of steam at the higher pressure, there are fewer lbs. used to do the same work, and the high pressure is the most economical.

(31) J. R. B. says: I propose running a boat by a screw. She is to be 16 feet long and of sharp bow; of how large a diameter should the screw be? A. Make one 18 to 22 inches in diameter and of $2\frac{1}{2}$ to 3 feet pitch, with a length of blade of 5 or 6 inches. Run it at 300 or 400 revolutions per minute.

(32) C. W. H. says: A boat is 100 rods from a stationary stump. A man in the boat is pulling 50 lbs. on a rope attached to the stump to pull the boat to the stump; and two men are in two separate boats 100 rods apart. Each man is pulling 50 lbs. on opposite ends of a rope between the boats to pull the boats together. The two boats are of equal weight, and all other conditions are equal. Will the one boat arrive at the stump sooner, later, or at the same time as the two boats come together? If not at the same time, how much sooner or later? A. As you have stated the proposition, the two boats would approach each other twice as fast as the single boat approaches the stump—for the reason that the rope is hauled in twice as fast in the first instance, as there are two men hauling it in, one at each end; and in the second instance only one man is hauling in rope, at one end, at the same rate as is employed by each of the two others.

(33) J. J. T. says: I wish to build a locomotive engine with vertical boiler 2 feet high. The cylinders are to be $2\frac{1}{4}$ inches bore by 5 inches stroke. What diameter will the boiler be, and how many 1 inch tubes should I use to get the most power? How much will such a boiler, with all attachments and full of water, weigh? How much power will it develop, if well

built, with pressure of 100 lbs. to the inch? A. The data sent are rather incomplete, but you will find rules by which you can calculate the answers to your questions on p. 225, vol. 33.

(34) S. D. C. asks: What is the complete formula for finding the radius of the earth at any place, when the force of gravity at that place, and at the equator, and the equatorial radius, are given? A. La Place's formula for the radius, at the latitude L, is: radius in feet=20888625×(1+0·0016742×cos. 2L). As we understand the premises in your other query, we do not think they are correct.

(35) W. S. says: 1. I am building a model horizontal engine 1½ x 3 inches, and wish to make a boiler for it capable of 65 lbs. pressure. What should be the size and the number of flues? A. You can make flues 1 inch in diameter, or less. 2. What would be the best speed to run it at, in order to get the most power? A. From 400 to 850 revolutions per minute.

(36) J. N. W. asks: How much suction power has a fan 2 feet in diameter, with four wings, 8 by 14 inches, revolving 2,000 times in a minute? The induction orifice is 1 x 24 inches. How many lbs. pressure can I produce at the orifice? A. If you wish more pressure than 1 lb. per square inch, it will be advisable to use some other form of blower.

(37) J. F. & G. W. M. says: There are two tanks for water located 900 feet apart. Each holds about 15,000 gallons. The bottom of one is 11 feet above level of ground and the tank itself is 14 feet high, making 25 feet from top of tank to level of ground. A pipe runs from this tank down into the ground, to sufficient depth to prevent freezing, and thence along on a level, 900 feet, to the other tank. The bottom of the last-named tank is 3 feet above top of the first-named tank, or 28 feet from level of ground. What size of pipe must I use to empty the water of the second tank into the first tank in 12 hours? What size of pipe will it take to do the same in 24 hours? A. To discharge the second tank into the first in 12 hours will require a pipe of 2 inches diameter, and in 24 hours 1½ inches diameter. The bends in the pipe should be easy, and no contraction of size, by valves or otherwise, should be allowed.

(38) W. J. M. asks: Do steam heating pipes consume the oxygen of the air, or is a degree of heat greater than that of pipes heated by steam necessary before the consumption of oxygen begins? Why is it that in an office, if doors or ventilators be closed for a few minutes only, the air becomes very oppressive and stupefying, while the temperature is yet not very high, and not as high as could be borne without any discomfort in a well ventilated room? Would a ventilating shaft, constructed so as to draw from a register in the floor, be of any benefit, or would the air, at the height of a man's hand, remain undisturbed and oppressive? A. Air when heated expands and becomes less capable of supporting animal life, because of the limited quantity of oxygen it then contains in a given volume. The breathing of persons engaged in a sedentary employment is slow, and a dense air would afford greater aliment to the blood in their case. There is no reason to believe that steam pipes, when heated, consume the oxygen of the air to a greater extent than other heating surfaces. But there is, without doubt, a minute quantity of moisture driven from the pipes by the internal pressure, which soon renders the air humid, and this has the effect of making breathing more difficult. It is easily inferred from this that supplying fresh air brings no remedy, unless the strong dense air thus admitted is preserved in this state, without being rarefied by the heated pipes. By gradually accustoming yourself to a lower temperature, some relief may be found, or by adopting the plan of the open fireplace, you may be able the more effectually to preserve the air of your room in its natural state, neither too dry nor too humid for easy respiration.

(39) A. B. asks: What are gold and silver alloyed with at the United States mints? A. The gold coinage is $\frac{9}{10}$ pure gold and $\frac{1}{10}$ alloy. The alloy consists of $\frac{1}{10}$ silver and $\frac{9}{10}$ copper. The silver coinage also contains $\frac{1}{10}$ alloy, which is copper only.

(40) J. McT. says, in reply to M. G. P., who asks if meerschaum pipes, after they have been used a time, are not subjected to some process to bring out the color: I have seen meerschaum and imitation meerschaum pipes colored by the following process: Fill the pipe and smoke down about one third, or to the height to which you wish to color. Leave the remainder of the tobacco in the pipe, and do not empty it or disturb it for several weeks, or until the desired color is obtained. When smoking, put fresh tobacco on the top, and smoke to the same level.

(41) E. McD. asks: 1. What quantity of oil of vitriol should be used to the gallon of water, for sprinkling guano for artificial manure? A. Dilute the strong acid with about 30 parts of water. 2. Is it necessary to distribute the dilute liquid throughout the body of material, or merely sprinkle the surface? If the latter, how deep should the layer be? A. Spread the guano into a layer about 3 inches in depth, and sprinkle; then put together again. 3. What quantity of the dilute liquid would be required for 100 bushels? A. This depends upon the amount of ammonia or its volatile salts which are contained in the guano. If it contains 6 per cent, it will require about 32 pints of the acid solution, about 2 gallons to the ton. 4. Would superheated or dry steam do as a dryer? A. Heated air would be more suitable. 5. Would it be advisable to make the deposit perfectly dry, or to allow a small percentage of moisture to remain? A. You cannot hope to expel all the moisture; and it is better not. 6. If the natural state of the deposit is 50 per cent water and 6 per cent ammonia, would not the evaporation of the water double the percentage of ammonia? Yes. 7. After the deposit is dried, could it not be put up in bags and shipped without fear of deterioration? A. If not exposed to the weather or very moist air, it will not absorb moisture after drying to any extent if tightly packed in strong bags.

(42) M. B. says: Given two lamps, one with a round and the other with a flat wick, the same number of threads in each, and everything else equal, is there any difference in the amount of light? If so which gives the most? A. There will be a difference in favor of the round wick if properly adjusted; but it will consume more oil.

(43) H. C. asks: Is there a way of softening rams' horns so as to be able to mould them? A. There is no practicable method whereby this may be accomplished.

(44) E. E. C. asks: What acids are most destructive to steel dies? A. Nitric, muriatic, and sulphuric acids attack and dissolve the metal most rapidly. Nitric, or a mixture of nitric and muriatic acids (*aqua regia*), are the proper solvents.

(45) T. H. S. says: 1. I am using a liquid made of 1 lb. sal soda and ¼ lb. lime to 1 gallon of water, which, when boiled, comes out as a lye. Of this liquid I use 2 or 3 spoonsful for washing of a boiler of clothes of the capacity of 8 or 10 gallons, with plenty of water. Will the liquid be injurious to the fabrics? A. Under the conditions, the washing fluid will not injure the fabric to any extent. The fluid may be made stronger by boiling with excess of lime and carbonate of soda (sal soda). 2. I use chloride of lime in a liquid state for bleaching the cloth, letting the cloth remain in the rinsing water for an hour or more. Will the chloride water be injurious to the cloth? Please give a formula to make the chloride water of the proper strength. A. Pass the cloth first through a very dilute bath of sulphuric acid, and immediately through a bath of bleaching powder (chloride or hypochlorite of lime), made by dissolving the powder in 24 parts of cold water, and hang in a close room with as much exposure to bright sunlight as possible. When properly bleached, wash well in water and dry.

(46) C. H. B. asks: How can a sword blade be frosted? A. Clean and polish the metal, flow it quickly with dilute nitric acid; and, when the proper point is reached, wash well in running water.

(47) V. S. A. asks: 1. What will soften brushes after they are used in varnish or French dryer? A. Steep the brushes for 24 hours in good benzole, and then, if necessary, purify by washing them with soap and warm water. 2. How can I preserve photograph proofs? A. Wash them well in cold running water, dry, and keep in a dark place. Or, after washing, fix them by immersing for a few minutes in a strong solution of hyposulphite of soda in water and wash or soak in a copious supply of cold water for 10 to 12 hours.

(48) A. P. asks: Can you furnish me a recipe to make a solution for setting the color of crayon drawings? A. Use a dilute aqueous solution of gum arabic in water, with the addition of a very little oil of cloves.

(49) A. R. asks: What can I use to repair a glass bath, that will resist nitrate of silver in strong solution? A. Warm the fractured edges of the glass uniformly, and join with fused gutta percha. The edges should be pressed firmly together and allowed to remain in the clamp for an hour, or until perfectly cool.

(50) C. asks: Will you give a chemical analysis of ox blood? A. In 100 parts of ox blood corpuscles there are: Water 68·8, solids 31·2. The solids are: Hœmatin (with iron) 16·75, globulin and cell membrane 28·222, fat 0·231, extractive matter 0·260, mineral substances (without iron) 0·812. The minerals are: Chlorine 0·1686, sulphuric acid 0·0066, phosphoric acid 0·1134, potassium 0·3328, sodium 0·1052, oxygen 0·0667, calcic phosphate 0·0114, magnesic phosphate 0·0073. These blood corpuscles are suspended in a liquid containing, in 100 parts: Water 90·29, fibrin 0·405, albumen 7·884, fat 0·172, extractive matter 0·394, mineral substances 8·55.

(51) C. F. M. asks: Is there anything that will give raw hide a fine finish and at the same time be waterproof? A. Steep them in a strong, hot decoction of sumac, alum, and logwood, and dress with a mixture of beeswax, soap, oil, and ivory-black.

(52) P. S. K. W. asks: How may paper be prepared so that linseed oil will not soak into it and that the paper will remain flexible? A. Pass the paper rapidly through strong sulphuric acid and wash quickly with a copious supply of water. After drying, pass through an aqueous solution of dextrin, and then between smooth rollers heated to 500° Fah. The rollers should be under a very considerable pressure.

(53) C. B. W. asks: 1. Is it true, as a general thing, that dress goods, wall papers, etc., in which a green color predominates, are poisonous? A. No. Scheele's green (arsenite of copper), because of its brilliant hue, is often used as a pigment in painting and in designs on wall papers, but not so frequently on dress goods. 2. Is it necessary to use poisonous matters to make a green color? A. No. Fabrics which have been dyed with some of the aniline colors have, at times, produced poisonous effects, especially where they have been permitted to remain for any length of time in direct contact with the moist cuticle; but not otherwise. 3. Whence came the idea that all green dyes are poisonous? A. Cases of poisoning from Paris or Schweinfurt green, verdigris, and like compounds containing copper or arsenic (the prevailing color of which is green) have been so numerous that all similarly colored pigments, dyes, etc., have gradually come to be considered with more or less of distrust by the uninformed.

(54) J. A. W. asks: Is there an acid or chemical which will corrode paper postage stamps, but will not corrode gum arabic? A. No.

(55) G. W. S. asks: How can I make a loaf of bread which, after a year or so, I can lay my hand on and squeeze it down, and it will rise up again the same as when fresh baked? A. If the bread is not intended for food, such a loaf may be made from flour in the ordinary way, but with the addition of a little sulphate of copper (a very minute quantity only), glycerin, and a strong aqueous solution of salicylic acid.

(56) W. W. asks: What is the best covering for headed haystacks, portable, durable, waterproof, vermin-proof, and cheap? A. Try the following: Take any coarse fabric, steep it for a few hours in a strong aqueous solution of alum, dry, and coat the upper surface with a thin covering of tar.

(57) G. R. asks: 1. Will a soft metal, like copper, lead, or zinc, hold heat longer than a harder metal like cast or wrought iron of equal weight and the same shape? A. The loss of heat does not depend so much upon the hardness of the metal as upon its conductivity and the condition of its surface. If the surfaces of the metal be bright and polished, it retains its heat much longer than if it be dark and rough; or, in other words, the less rapidly will it part with its heat by radiation. The poorer the heat conductivity of the metal, the longer it will retain its heat, other conditions being the same. The conductivity of silver being 100, that of copper is 73·6, zinc 19·9, tin 14·5, steel 12·0, iron 11·9, lead 8·5. The time required to cool a large mass of hot metal is proportionately great compared with that required to reduce the temperature of a smaller mass the same number of thermometric degrees. 2. Will glass retain heat as long as soft or hard metals? A. Yes.

(58) C. A. B. says: I have eight or ten pieces of sponge rubber bought about two years ago; it was then very good and would clean paper very nicely. It is now hard, and slides over the paper without cleaning it. Can it be restored, so that it may clean paper as well as ever? A. No. The hardening is due to oxidation. The quality cannot be restored.

(59) O. H. N. asks: Is there any way of cleaning sulphur off horseshoes? When I weld the toe calk on, the sulphur gets under the toe calk, and I cannot weld it. A. Use common carbonate of potash or soda.

(60) H. & M. say: We wish to test the quality of different lots of coal oil sent from refineries. Could you give us a mode of doing this? A. Inexpensive instruments for this purpose are sold by dealers in thermometers, hygrometers, chemical utensils, etc. All that is necessary for ordinary purposes is to determine the specific gravity and point of ignition. The former is accomplished by means of an instrument resembling a hydrometer, and the latter by heating a small quantity of the oil in which the bulb of a thermometer is immersed to indicate the temperature, and a small ignited taper, held close to the surface of the oil, ignites the same when the temperature has risen sufficiently.

(61) M. N. asks: Is there any metal or composition which would stand the same usage as a cane, and could be moulded hollow? A. Steel or bronze would answer the purpose, if we understand you aright.

(62) C. B. P. asks: How can I platinize the silver plate of a Smee battery? A. Dip the plate in a strong solution of chloride of platinum, and expose it for a short time to the action of a stream of hydrogen or coal gas. 2. How can I prepare sulphur for making casts of coins, etc.? A. Fuse the sulphur and heat it to the point of sublimation, and while in this condition throw it into cold water.

(63) A. J. S. says: I have a lot of emery wheels that have been almost covered with japan dryer. What will remove the japan without injuring the wheels? A. Remove all you can by mechanical means, and then treat the parts with strong oil of vitriol (sulphuric acid) for a few minutes; then wash well, but quickly, in a stream of water. Repeat this treatment if necessary, and rub well with sawdust. The acid should not be permitted to remain for any length of time in contact with the stone, as it will injure it.

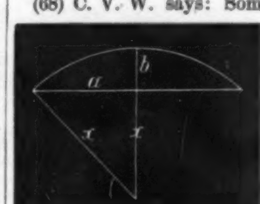
(64) C. W. C. asks: How can I keep lemons for 6 months or more? A. Packing them in salt and keeping in a cool place is one of the best methods; but even this will not always suffice.

(65) C. H. J. says: Some specimens of limestone rock were excavated from a quarry. The specimens taken out during the spring and summer, which were allowed to season, answered admirably, but those taken from the quarry during or just previous to a cold snap cracked by the action of frost. Can you suggest means by which these stones may be tested, other than by subjecting them to extreme cold? A. The cause of the cracking of the stone may have been the molecular energy of freezing water contained within cavities in the rock; but it is more probable that the rupture was due to the relaxation of strain to which the blocks had been subjected while in the quarry. Splitting up of blocks from this cause is by no means infrequent in some quarries. If the breaking is attributable to the action of frost, there is no other means than those you mention for testing the stone. If it is due to the unequal strain upon the block, the splitting cannot be avoided.

(66) M. asks: Can you give me a recipe for making concentrated starch? A. We do not know of any preparation by this name.

(67) G. S. says: I have some specimens of copper ore that are covered with verdigris. What shall I use to take it off? A. If it is really verdigris, a little dilute sulphuric or hydrochloric acid will remove it.

(68) C. V. W. says: Some of your correspondents ask for a method of finding the radius of a circle when the chord and versed sine are given. I give them a very simple formula based upon the well known property of the right angled triangle. Where



$a=\frac{1}{2}$ chord, b=height or versed sine, and x and x=radii,

$$a^2+(x-b)^2=x^2=\frac{a^2+b^2}{2b}=x \text{ or } \frac{\frac{1}{2}\text{ chord}^2+\text{height}^2}{2\text{ height}}$$

(69) J. H. M. says: I am running saws of 8 inches diameter, and smaller. I wish to know at what to run them in order to make the smoothest work? A. Nine thousand feet per minute, that is nearly two miles per minute, for the rim of a circular saw to travel, may be laid down as a rule. For example: a saw 12 inches in diameter, 3 feet around the rim, 3,000 revolutions; 24 inches in diameter, or 6 feet around the rim, 1,500 revolutions; 3 feet in diameter, or 9 feet around the rim, 1,000 revolutions; 4 feet in diameter, or 12 feet around the rim, 750 revolutions; 5 feet in diameter, or 15 feet around the rim, 600 revolutions. Of course it is understood that the rim of the saw will run a little faster than this reckoning on account of the circumference being more than three times as large as the diameter. Shingle and some other saws, either riveted to a cast iron collar or very thick at the center and thin at the rim, may be run with safety at a greater speed.—J. E. E., of Pa.

(70) D. B. says; I notice an article stating that Dr. Siemens had succeeded in producing permanent magnets capable of suspending 20 times their own weight, by mixing with steel a small proportion of tungsten. Can this be so? A. Yes, so far as we know; small artificial magnets have been made to sustain one hundred times their own weight.

(71) C. W. C. says: If a telegraph wire passes over a building, or in close proximity to it, does it endanger it during a thunderstorm? A. No. So far as it has any influence, it acts as a protector.

(72) J. W. T. asks: Is there any electric battery that will heat and keep a ⅛ inch wire red hot or nearly so? A. The question is very indefinite, as everything depends upon the length and material of which the wire is composed. Probably a Bunsen cell could be made sufficiently large to heat a short length of platinum of that diameter.

(73) V. W. S. asks: If a dwelling is surrounded by trees, from 10 to 25 feet higher than the ridge or the chimney tops, and within one or two rods distance from the house, are not these trees some protection against lightning? And if not, would not conductors in the trees answer a better purpose than is secured by the usual mode of attachment to the building? A. Properly constructed rods on the building are much better in every respect.

(74) T. B. A. says: What size of wire do I want to make an induction coil, to be used to heat platinum wire? A. Use a Grove or Bunsen battery. Either is better than a coil.

(75) A. A. W. says: I have a book that gives a rule for finding the safe working pressure of any boiler, but I cannot work it satisfactorily. The rule is: Multiply the thickness of iron by 0·56 or 0·70, according as the boiler is single or double riveted, multiply this product by 10,000 (safe load), then divide this last product by the internal radius less the thickness of iron. The quotient will be the safe working pressure in lbs. per square inch. A. Calling C a coefficient 0·56 or 0·70, as the case may be; T, thickness of boiler in fractions per inch; R, internal radius of boiler in inches; L, safe load in lbs. per square inch. Working pressure$=\frac{C\times T\times L}{R}$

(76) J. P. asks: How can I make old copper and brass coins stick to a board without using tacks? A. Melt together in a suitable vessel equal parts of pitch or asphalt and gutta percha. Apply hot. Clean the coin with a little dilute nitric acid or oil of vitriol.

(77) J. Z. R. says: I inclose a small piece of carpet. I want to dye it some other color. Which will be the best? A. As the carpet already contains so many dark colors, it would be impossible to dye it any color but black, without first having bleached it; and this, in the present instance, is impracticable.

My kitchen ceiling blisters and scales off. It has been whitewashed sometimes with lime and sometimes with whiting. What shall I do with it? A. This is very probably due to dampness, in which case the best plan is to clean and paint the walls.

I want to make a photo background. What is the best color to use? A. Any of the aniline colors may be used for this purpose; you can purchase them, already prepared and with instructions for use, of any druggist. Any oil paint may be rendered flexible, when dry, by rubbing it up with a little soap and glycerin over a fire.

(78) A. S. C. asks: 1. What amount of carbolic acid is used in a lb. of carbolic soap? A. Samples of these soaps, that we have examined, contained about three per cent of the crude phenol in combination as a soda salt. 2. How is it mixed? A. In the coarser varieties of these soaps, the phenol is added directly to the lye during the latter part of the saponification; but in these cases the acid is very incompletely distributed through the body of the soap. A complete and uniform dissemination of the phenol may be obtained by dissolving soap and carbolate in hot spirits of wine or wood naphtha, and evaporating the solution to dryness.

(79) B. F. W. says: Joshua Rose says, in relation to sawing staves for cylinder or pipe patterns: "It will save time to resaw the pieces to give them the required bevel, which may be done by canting the saw table." A better practice is to cant the table before sawing at all, and then the staves will be of the right shape, with a saving of nearly two thirds of the sawing and considerable timber.

(80) C. H. says: We have in our possession an old-fashioned range; and whenever we draw hot water the water has the appearance of milk, but after standing a few minutes it regains its regular color. We have been advised not to use the water. A. This is due to the precipitation of the lime contained in the water. Lime is less soluble in hot than in cold water. It is not generally advisable to use water from the hot faucet for culinary purposes, as it may contain poisonous copper and lead salts.

(81) J. A. K. says: 1. I use oxalic acid for preparing pale leather boot work (a teaspoonful of oxalic acid in a pint of water). The mixture sometimes becomes a brownish color. Do you know of any kind of acid which would do instead of oxalic? A. Try moistening the leather first with oxalic acid, as usual, and then with a strong solution of chloride of lime (hypochlorite of lime) in cold water. 2. Do you know of anything to put in ink to give a good gloss? A. Use an alcoholic solution of wax.

(82) J. W. P. asks: What will remove stains of tannic acid from linen and other fabrics? A. Wash well with a little soda, moisten with very dilute sulphuric acid, and then with a strong solution of bleaching powder (chloride of lime) and expose for an hour to bright sunlight. Then wash well in water.

(83) X. Y. Z. asks: Can the skins of birds be tanned with the feathers on? A. Yes, but not without discoloring the feathers.

(84) E. W. W. asks: How can holes be readily pierced, or small holes enlarged, in rubber corks for the fitting of glass tubing? A. Force the stopper into the neck of a flask or large glass tube which it will just fit into, and use a well sharpened cork borer with gentle pressure and even turning. If you desire to enlarge a former hole, first plug it tightly with a piece of glass rod and proceed as before.

Is there any table published of relative chemical affinities by which one may get at the amount of force necessary to dissociate the elements in certain compounds? B. We know of no such table.

(85) W. A. H: says: I have a relay of the box pattern, containing a magnet of about 40 ohms. There is a certain peculiarity I notice, which I would like to have you explain. I notice that whenever the current is broken by opening of the key, a peculiar jump is heard, a kind of kick or hammering. At first I thought the magnet was loose; but after making it as tight as possible, it acted in the same manner. A. The noise is occasioned by a change in the molecular condition of the iron core when magnetized and demagnetized.

(86) S. I. asks: 1. What length and size of insulated wire is required to wind the magnets of a relay, such as is used on ordinary telegraph lines? A. About 1,000 feet of No. 32. 2. What would be the proper dimensions? A. The core can be $1\frac{1}{4}$ inch long and about $\frac{3}{8}$ inch in diameter.

(87) H. L. J. says: Makers of telegraph apparatus use a kind of lacquer or varnish on their brass work which prevents tarnishing, while it is so thin as to avoid muffling the sound. What is it, and how is it prepared? A. Shellac and alcohol are the principal ingredients, colored by gamboge, saffron, turmeric, etc. About 2 gallons alcohol to 1 lb. shellac is the proportion.

(88) G. W. H. says: 1. I am making an induction coil to throw $1\frac{1}{2}$ inches spark, to light gas. Of what diameter and length shall I turn my bobbin? A. Use about 2 miles of No. 36 wire for the secondary. 2. What size of wires shall I use? A. Make the core $\frac{3}{4}$ inch or an inch in diameter and about 8 inches long. 3. I have some tinfoil 5 inches wide to make a condenser with; how much in length will it take? A. One hundred feet of the foil will probably be enough.

(89) C. C. S. asks: Can I conduct the smoke and exhaust from a 4 or 6 horse power farm engine through tile laid underground (on a constantly ascending grade; to a stack 100 or 125 feet distant? A. This is frequently done.

(90) A. V. V. says: Two boilers, one 8 feet in diameter and the other 6, each containing the same number of flues and each having a steam gauge indicating apparently the same number of lbs. of steam; which boiler has the most steam in it? A. If the larger boiler has the most steam room, it contains, of course, the greatest weight of steam.

(91) W. H. L. asks: Why is it objectionable to raise the safety valve of a boiler in case of low water and danger of explosion? A. It is not desirable to do anything that may cause the water to rise and come in contact with overheated iron.

(92) R. M. asks: How can I raise a valve by change of temperature? A. There are numerous devices of this kind in common use. By inserting a notice in the "Business and Personal" column, you can probably gain full information.

(93) A. B. says: Please give me the scientific definition of the word "inertia?" A. Brande says "This term is used to denote the principle or law of the material world, that all bodies are absolutely passive or indifferent to a state of rest or motion, and would continue for ever at rest, or persevere in the same uniform and rectilinear motion, unless disturbed by the action of some extrinsic force."

(94) A. B. S. asks: Will a pump draw water any easier by having the pipe to the well larger than the connection to the pump, and will an injector lift the water any easier by having the suction pipe in the well larger than the pipe to the boiler? A. By using a larger pipe, the friction is diminished.

(95) J. D. S. asks: What is the best manner of determining when a millstone is in wind? A. Use a red staff, or straight edge covered with red paint, which will show all the high spots.

(96) E. M. P. asks: What are the best methods of reversing motion? A force is used to accumulate or store up a certain amount of power, then that stored-up power is desired to produce or exert its force. By what mechanism can this be effected? A. Sometimes a flywheel is used, a spring may be compressed, a weight may be lifted, or a reservoir may be filled with water. Flywheels, springs, and weights are among the most common means employed.

(97) C. W. asks: What would be a safe steam pressure to carry in a cast iron cylindrical shell of 10 inches inside diameter and $\frac{1}{16}$ thick, with heads $\frac{3}{8}$ thick? A. You can carry 200 lbs. if the casting is sound; but cast iron boilers frequently have points of weakness that render theoretical calculation of their strength of little value.

(98) W. L. M. says: Astronomers tell us that it has been calculated, from the rapidity of the rotation of the earth, that, if the earth were suddenly intercepted in its motion, sufficient heat would be generated to melt the earth instantaneously. What would be the generator of this heat? A. According to the modern theory of heat, a unit of heat and 772 foot lbs. of work are mutually convertible, motion being the generator of heat.

(99) T. A. asks: Can a turbine or other water wheel be considered an hydraulic power? A. It can, in a general sense, just as much as a steam engine may be spoken of as steam power. Strictly, the term applies to the power furnished by the motor.

(100) Y. M. asks: 1. What is the meaning of the mass of a body, when the weight is divided by the gravity to find it? A. It is a measure of the quantity of matter, and in order to give the same results with the same body at all places in the earth's surface. 2. What is a circular inch? A. It is the area of a circle having a diameter of 1 inch. 3. What is a cylindrical inch? A. It is the volume of a right cylinder with circular base, diameter of base 1 inch, altitude 1 inch.

(101) C. F. says: When the water in my boiler stands between the two gauges (about 3 inches above top flues) and I start the engine, the water will instantly rise from 6 to 8 inches or nearly up to the dry pipe. As soon as I stop the engine, the water drops back to its original position. We know it is not foaming, as we have blown off the boiler several times, and it is perfectly clean. We use soft water. A. The rise of the water is probably due to insufficient steam room, or possibly because the fire is forced too much. We judge, from your account, that no injurious action takes place. There are several other reasons that might be effective in causing the water to rise, but those given above are the most probable.

(102) I. W. L. says: 1. I have been told that I can make a battery for gold and silver plating as follows: Take a piece of copper $1\frac{1}{2}$ inches in diameter and $\frac{1}{4}$ inch thick, and a piece of zinc of the same size. Attach a copper wire to each in a glass vessel $\frac{1}{2}$ full with a piece of bluestone. The zinc is to be on the top. These wires are to go to the bath. Is this right? A. The plates should be much larger to give good results, and the copper need not be so thick. 2. How can I make the bath? A. Make a solution by dissolving cyanide of gold in cyanide of potassium, about $\frac{1}{2}$ oz. of gold per gallon. Connect the article to be plated to the zinc of your battery. 3. How long should the articles be in the bath? A. Until the deposit is of the desired thickness.

(103) W. S. W. says, in answer to M. P., who asks for watch oil: Put 1 oz. pure olive oil in a tumbler, add 2 ozs. of 96 per cent alcohol, stirring well; set it away in a dark place for 24 hours or more, well covered, then pour into a clean bottle containing 10 ozs. distilled or clean rain water. Shake violently for 5 minutes, allow the mixture to stand $\frac{1}{2}$ hour or so, then freeze with salt and ice. You will find a good article of fine limpid watch oil, perfectly fluid, at top. Draw off with a siphon.

(104) L. G. says: A string or cord being attached to a piston rod directly, the engine being of one horse power, what weight must I put on the cord to test the strength of the engine? A. This depends upon the speed of the piston. The measure of a horse power is the work of lifting 1 lb. 33,000 feet high in a minute, or 33,000 foot pounds per minute; so that if you divide 33,000 by the speed of the piston in feet per minute, the quotient will be the required weight.

(105) H. E. W. asks: 1. Why do nearly all manufacturers of electric annunciators and indicators for burglar alarms wind the magnets with wire of No. 28, and finer? Why not use No. 20 to 26? A. In many cases, Nos. 20 or 26 wire would be preferable; but with finer wire the battery does not require so much attention as might be necessary if coarser wire were used. 2. Will cotton covered answer as well as silk covered? A. Any kind of insulation will answer. Silk is better than cotton, as ordinarily put on, as it takes up less room. 3. What size of cores, and how many feet of wire on each core will give the best results? A. Cores are usually made about $1\frac{1}{4}$ inches long and $\frac{3}{8}$ inch thick for annunciators; 250 feet of wire will answer for both cores. 4. Will an electro-magnet ever lose its power or become useless? A. Not with proper care, except that everything wears out with age.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

G. M. P.—No. 1 is hauerite, sulphide of manganese. No. 2 is idocrace, a silicate of lime, alumina, and iron. No. 3 is tremolite, a silicate of lime and magnesia.—D. A. C.—S is a clay ironstone, containing much sulphide of iron (pyrites). G is graphite mixed with much clay. D appears to contain a small amount of sulphide of lead in a granite matrix. Your letters were insufficiently stamped to the amount of 24 cents.

R. K. says: A friend tells me that a single, a double, a triple, and quadruple thread, either right or left hand, can be cut by one and the same pair of ordinary stocks and dies. Can this possibly be true?—G. S. W. asks: Is there any rule for dividing a circle into 3, 4, or more equal parts by parallel lines?—G. E. C. asks: How can I bend the sides of a guitar? Should they be steamed?—W. H. B. asks Can you tell me how to bisect a triangle by a straight line passing through any given point within the triangle?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Friction of Slide Valves. By F. G.
On Force. By ——.
On Cleopatra's Needle. By J. W. P.
On an Old Problem. By B. B.

Also inquiries and answers from the following:
J. P. B.—T. H. C.—W. C. Y.—R. F.—E. P.—T. S. P.—C. W.—J. B. B.—J. K.—T. H. G.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells blue glass lamp chimneys? Who sells machines for stitching magazines, etc., with wire? Who sells working models of steam engines? Who makes iron chain? Who makes the best medical electric apparatus?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 13, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Addressing machine, J. H. Williston	187,335
Advertising device, W. A. Brice	187,252
Air and steam blower, B. Hershey	187,381
Bag holder, B. J. C. Howe	187,277
Bale hook, H. Hauschildt	187,373
Bale tie, G. F. Jones	187,284
Barbed wire, twisting, E. P. Peacock	187,306
Bed, air, Macintosh & Boggett	187,397
Bed bottom, spring, A. W. Kendrick	187,229
Beer cooler, L. M. Davis	187,219
Bessemer steel, making, Hunt & Wendel	187,386
Binder, temporary, G. W. Emerson	187,367
Blacking box, S. W. Valentine	187,434
Bolt heading machine, G. R. Moore	187,294
Book support, J. & R. Lamb	187,393
Boots, etc., making, D. A. Sutherland (r)	7,510
Bracket, adjustable, G. P. Davis	187,361
Breech-loading fire arm, A. J. Hudson	187,280
Breech-loading fire arm, H. Rowell	187,319
Brick kiln, E. W. Bingham (r)	7,504
Brick kiln, W. S. Colwell	187,217
Brick machine, T. J. Davis	187,359
Broom, T. R. Evans	187,368
Broom and brush, S. M. Barrett	187,346
Buckle, F. W. Schafer	187,237
Burglar alarm, W. D. Wright	187,445
Butter mould, F. Hirst	187,275
Button, S. W. Shorey	187,325
Button or stud, H. S. Wing	187,442
Can, sheet metal, G. H. Chinnock	187,216
Can, sheet metal, J. S. Field	187,260
Capstan, reverse power, T. W. Hyde	187,282
Car axle box, C. E. Candee	187,352
Car starter, R. R. Carpenter	187,355
Car, steam street, L. Ransom	187,314
Car wheel chill, W. Wilmington	187,441
Carbureting air, apparatus for, A. C. Rand	187,415
Carpet stretcher, G. C. Banta	187,345
Carpet sweeper, W. S. Hall	187,374
Carriage seat, turn over, C. W. Patten	187,304
Cauterizing apparatus, C. Paquelin	187,301
Chair, P. Kamerer	187,389
Chuck, J. H. Westcott	187,438
Churn, G. W. Knapp	187,285
Cider press, R. C. Quinn	187,312
Circuit closer, electric, Rousseau & Smith	187,318
Clasp for suspenders, G. B. Gurley	187,269
Cloth cutting machine, M. L. Hodson	187,383
Clothes pin, W. N. Lockwood	187,291
Coal scuttle, W. Richards	187,315
Coffee filter, M. O'Connor	187,407
Cold, artificial, R. P. Pictet	187,413
Corn harrow, E. Martin	187,398
Corn stalk cutter, W. Gans	187,371
Corset clasp, W. S. Phyfe	187,308
Corset dummy, J. J. Wilson	187,336
Cradle, C. O. Sobinski	187,426
Crank, compensating, R. D. Milne	187,402
Croquet stand, A. Erlebach	187,259
Cultivator, R. B. Robbins	187,235
Cultivator, hand, J. W. Dowler	187,222
Curtain fixture, H. Seehausen	187,422
Desk and chest of drawers, G. S. Sykes	187,429
Deodorizing closets, A. Hanel	187,270
Door sill, A. Saur	187,419
Draft attachment, Otto & Simon	187,410
Draft equalizer, S. H. Pierce	187,309
Drafting scales, J. Lyman	187,290
Drawers, G. W. Walgrove	187,332
Dress protector, D. R. Harder	187,377
Drop light, C. Henry	187,380
Earth auger, G. Watson	187,241
Egg beater, M. C. Russell	187,417
Engine, rotary, P. D. M. Carmichael	187,215
Engine, rotary, R. W. Skirrow	187,326
Engines, mounting portable, R. M. Beck	187,348
Envelope, J. J. Hayden	187,379
Excavating apparatus, A. W. Johnson	187,283
Fats, process of treating, A. Springer	187,327
Feathering paddle wheel, W. Webster	187,436
Fence, J. W. Webster	187,334
Fence post, Wing & Thompson	187,337
File, W. T. Nicholson	187,298
Fire arms, etc., sight for, C. A. L. Totten	187,432
Fire kindler, S. W. Mather	187,399
Fire shield, L. W. Wright	187,340
Flour and meal sifter, C. O. Peck	187,307
Flue cleaner, G. W. Clough	187,255
Fork for green corn, etc., table, F. M. Dixon	187,363
Fruit drier, R. B. Blower	187,349
Fruit jar, J. A. Nichols	187,406
Furnace for brickkilns, H. W. Adams, Jr	187,243
Furnace bridge wall, T. King, Jr	187,391
Furniture top, J. T. Bailey	187,344
Gas burner, S. C. Salisbury	187,418
Gas burner, self-lighting, R. R. Moffatt	187,403
Gate, tilting, I. Brokaw	187,253
Gelatin capsules, cutting off, F. A. Hubel	187,279
Glass door block, W. Beck	187,246
Grain binder, C. B. Withington	187,443
Grain drier, J. Guardiola	187,268
Grinding awl blanks, J. G. Dimond	186,257
Hame fastener, J. C. Moore	187,295
Harrow, D. W. Baird	187,447
Harrow cultivator, C. La Dow	187,392
Harrow, revolving, O. P. Fisher	187,370
Harvester, E. D. Stewart	187,328
Harvester rake, J. H. Myers	187,296
Hay press, P. K. Dederick	187,220
Heater, friction, W. Wells	187,242
Heating cars, C. C. Converse (r)	7,506
Hedge trimmer, J. A. McMarlin	187,401
Hoe, J. R. Hood	187,228
Hoisting machine, H. Snowden	187,425
Hoop skirt, E. K. Bullock	187,350
Horse blanket attachment, J. C. Ayres	187,342
Horse power, J. H. Elward	187,366
Hose coupling, E. A. Leland	187,395
Ice creeper, Bartlett & Lewis	187,347
Ice creeper, J. D. Porter	187,234
Insect destroyer, G. B. Drum	187,258
Ironing table, E. H. Caylor	187,254
Jacket, C. B. Moulton	187,405
Knitting machine needle, F. Burns (r)	7,505
Label holder, J. B. Gathright	187,372
Ladder, extension, O. Sherwood, Jr	187,324
Lamp, Arnold & Blackman (r)	7,502
Lamp, S. S. Newton	187,409
Lamp shade and globe, F. S. Shirley	187,423
Lamp shade holder, C. Votti (r)	7,511
Lath-making machine, Shaw & Kennedy	187,323
Lathes, rest for metal, T. F. Carver	187,353
Leather, dressing, M. Shaw (r)	7,509
Loom shuttle box, J. Hyde	187,281
Loom, shuttle, narrow ware, Fischer, Kek, & Sharp	187,369
Lubricator, D. Jenkins	187,387
Lubricator, W. Schindler, *et al.*	7,508
Malt extract, making, H. R. Randall	187,313
Malt syrup, making, Boomer & Randall	187,250
Milk cooler, W. V. Walker	187,333
Mineral water, making of, E. Cornelis	187,257
Mining machine, C. M. Hall	187,225
Miter box, H. L. McClain	187,293
Miter machine, J. P. Tierney	187,431
Moth proof safe, A. H. Clark	187,356
Motor spring, C. H. Slicer	187,424
Napkin holder, E. C. Bickford	187,247
Napkin holder, F. W. Campbell	187,214
Nut lock, K. C. Naylor (r)	7,507
Organ pipe, C. Fogelberg	187,261
Paint, making metallic, D. D. Parmelee	187,303
Paper, wood grinder for, G. H. Mallary	187,292
Parallel ruler, E. J. Towne	187,330
Pen holder, D. M. Somers	187,238
Pipe coupling, W. H. Bailey	187,343
Pipe coupling, E. A. Leland	187,394
Pipe tongs, A. E. Gay	187,265
Plaiting machine, Nickerson & Blanchard	187,299
Plow, G. Black	187,249
Plow, J. Ruch	187,320
Plow, ditching, D. N. Maxwell	187,400
Press, double acting, L. Prahar	187,311
Pump, J. W. Rider	187,416
Pump valve, W. Painter	187,411
Railroad tracks, raising, G. Schwartz	187,421
Railway, pneumatic, W. H. Bailey (r)	7,503
Refrigerating apparatus, Carre & Jullien	187,354
Re-rolling old rails, H. Greer	187,224
Revolving fire arm, Ayres & Whittaker	187,244
Rope, stand or reel for, D. M. Haight	187,271
Rowlock, R. W. Hathaway	187,227
Sash fastener, M. Foster	187,263
Sash fastener, D. S. Roberts	187,316
Sawing and grinding, B. C. Tilghman	187,240
Sawing stone, R. A. Tilghman	187,239
School desk, H. R. Fry	187,263
Screw cutting die, Bishop & Johnson	187,248
Seal, metallic, E. A. Locke	187,396
Seed dropper, W. H. Pennal	187,412
Seed planter, J. R. Sample	187,321
Sewing machine thread cutter, J. Doyle	187,365
Shackle, H. W. Dilg	187,362
Shawl strap bar, extensible, L. Lewine	187,289
Sheep shears, W. George	187,266
Sitter, N. W. Starr	187,427
Signal lantern, R. J. Hamilton	187,376
Sink guard and cover, A. S. Hodges	187,276
Sizing, composition for, N. Crabtree	187,218
Sled coupling, bob, T. Bruner	187,218
Sleigh and shoe, D. J. Hendrickson	187,273
Soap composition, J. W. Bartlett	187,245
Soda water apparatus, O. Zwietusch	187,446
Spittoon, L. H. Wooden	187,444
Steak tenderer, A. J. Davis	187,360
Steam boiler furnace door, W. W. Hubbell	187,384
Steam boiler tube, fastening, D. Hess	187,382
Steam trap and boiler feeder, Vandecar & Harper	187,331
Stone and ore crusher, C. E. Hall	187,375
Stone and ore crusher, A. Pollok	187,414
Stone, artificial, J. L. Wray	187,338
Stove pipe shelf, W. L. Hess	187,274
Stove pipe elbow, A. C. Hogen	187,385
Stove polish, L. C. Harvey	187,378
Straw cutter, E. Wagoner (r)	7,512
Table stand, iron, Osborn & Drayton	187,300
Ticket book, P. Deusner, Jr	187,221
Tooth picks, making, J. L. Duryee	187,223
Torch, J. A. McPherson	187,232
Toy puzzle block, F. P. Schmitthenner	187,420
Toy, sectional, L. Schmetzer	187,322
Trap for preventing inflow, W. F. Downey	187,364
Tree shield, self-adjusting, A. Roff	187,317
Triturating metal powders, etc., D. D. Parmelee	187,302
Trunk clamps, making, Gould & Feick	187,267
Truss, J. W. Sutton	187,428
Tube brush, A. W. Abrams	187,341
Type machine, A. M. Howard	187,278
Undergarment, C. C. Curtis	187,358
Valve, stop, W. F. Thacher	187,329
Valve, straightway, D. Kennedy	187,230, 187,231
Valve, throttle and check, Goodwin & Essex	187,373
Vapor burner, E. F. Rogers	187,236
Vehicle spring, L. A. Fogg	187,262
Ventilating faucet, O. H. Larson	187,286
Ventilating railway cars, H. King	187,390
Ventilator, G. A. Unkrich	187,433
Ventilator and alarm, W. F. J. Thiers	187,430
Voltaic plaster, W. B. Potter	187,310
Wagon brake, D. C. Montgomery	187,404
Wardrobe, W. H. Harris	187,226
Watch, repeating, A. L. Junod-Pattus	187,305
Water closet, J. E. Boyle	187,251
Water closet, ventilated, H. Ogden	187,408
Water closets, etc., seat for, J. J. Weeks	187,437
Water elevator, A. Wright	187,339
Water meter, W. Park	187,233
Windmill, D. Bull	187,351
Windmill, E. A. Dana	187,256
Windmill, W. D. Nichols	187,297
Windmill, J. G. Watson	187,435
Windmill, L. H. Wheeler, Jr	187,440
Windmill, W. H. Wheeler	187,439
Wood boring machine, B. F. Joslyn	187,388
Wrench, E. A. Leland	187,287
Wrench, ratchet, E. A. Leland	187,288

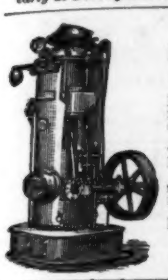
DESIGNS PATENTED.

9,739.—PAPER BOXES.—N. D. Bill, Springfield, Mass.
9,740.—EMBROIDERY.—B. Dreyfuss, New York city.
9,741.—LICORICE.—H. T. Jarrett *et al.*, New York city.
9,742.—VAPOR STOVE.—E. F. Rogers, Chelsea, Mass.
9,743.—SCALE BASE.—F. W. Troemner, Philadelphia, Pa.
9,744.—GLASSWARE.—H. P. Pears, Pittsburgh, Pa.

[A copy of any of the above patents may be had by remitting one dollar to MUNN & CO., 37 Park Row, New York city.]

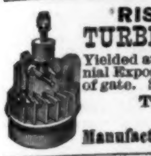
Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.



THE
TRADE ENGINE.

Noiseless in operation—Perfect in workmanship—all light parts of Cast Steel.
Every Engine indicated, and valve corrected to give the highest attainable results.
Warranted superior to any semi-portable Engine in the market!
Send for Price List and Circular.
HERRMANN & HERCHELRODE M'F'G CO., Dayton, Ohio.



RISDON'S IMPROVED TURBINE WATER WHEEL
Yielded at the test of Turbines at Centennial Exposition the best results at all stages of gate. Send for circular to
T. H. RESDON & CO., Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

500 CHOICE VARIETIES OF **PLANTS** for house and garden culture, sent by mail, free of postage. Send stamp for Illustr'd Cat. Address **L. B. CASE, Richmond, Ind.**

Send for Descriptive Catalogue of **RELIABLE** Vegetable and Flower **SEEDS** containing 192 pages on SEEDS and Plants mailed free. **H. A. DREER,** SEEDSMAN AND FLORIST, PHILADA.

WE ENAMEL
in FINE JET BLACK every variety of turned wood work parts of machinery, castings, tin-ware and other metal work ENAMELED JET GOODS, in wood or metal, made to order. AMERICAN ENAMEL CO. 17 WARREN ST PROVIDENCE, R.I.

A FLY-WHEEL ACCIDENT.—With drawings, showing the faulty construction of the fly wheel, the reasons for the breakage; with practical directions for the avoidance of such occurrence. By Joshua Rose. SCIENTIFIC AMERICAN SUPPLEMENT No. 30. Price, 10 cents.

OTIS' SAFETY HOISTING **Machinery.**
OTIS BROS. & CO., No. 348 Broadway, New York.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).
The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that were owners fully aware of the small difference which now exists between the use of Wood and Iron, that in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

ARSENIC IN THE ARTS.—A Lecture before the Medical Association of Central New York. By S. A. Lattimore, LL.D., Professor of Chemistry in the Rochester University. A popular and important paper. SCIENTIFIC AMERICAN SUPPLEMENT No. 29. Price, 10 cents. To be had at this office and of all newsdealers.

A NEW DEPARTURE. TRAVELING and local salesmen wanted. STAPLE GOODS. NO PEDDLING. Salary $75 a month. Hotel and traveling expenses paid. S. A. GRANT & CO., manufacturers of ENVELOPES and PAPER, 2, 4, 6, and 8 Home St., CINCINNATI, OHIO.

$66 a Week in your own town. Terms and $5 outfit free. H. HALLETT & CO., Portland Maine.

MACHINERY
OF EVERY DESCRIPTION,
COLD ROLLED SHAFTING, HANGERS, PULLEYS, COUPLINGS, BELTING, TANITE EMERY WHEELS AND GRINDERS, IN STOCK.
GEORGE PLACE, Machinery Agency,
121 Chambers & 103 Reade Sts., New York City.

SHAFTS, PULLEYS, HANGERS COUPLINGS ETC.
In Stock, and for Sale by
WILLIAM SELLERS & CO.,
Philadelphia, and 79 Liberty St., New York.
Price lists and pamphlets on application.

WANTED Salesmen to sell light hardware to *Dealers*, NO PEDDLING. Salary, $1,200 a year. Hotel and traveling expenses paid. Address DEFIANCE M'F'G CO., Chicago, Ill.

Pond's Tools
Engine Lathes, Planers, Drills, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND, **Worcester, Mass.**

HOME-MADE TELESCOPES.—Directions for their construction, with engravings showing the proper arrangement of lenses and tubes. By Prof. Van Der Weyde. Price, 10 cents. SCIENTIFIC AMERICAN SUPPLEMENT No. 1.

OPIUM and Morphine habit cured painless: No Publicity. Dr. CARLTON 187 Washington St., Chicago, Ill.

50 Visiting Cards, with name, 10c. and stamp. Ag'ts Outfit 10c. L. C. COE & CO., Bristol, Ct.

CONCRETE DOCKS OF NEW YORK.—With two engravings, showing the Foundations of the Docks and the method of making the Concrete Blocks. SUPPLEMENT No. 23. Price, 10 cents.

ROOTS' FORCE BLAST BLOWER.

FIRST PREMIUM
AWARDED
AT
PARIS AND VIENNA.

SPEED ONLY 100 TO 250 REV. PER M. SAVES HALF THE POWER REQUIRED FOR FAN.
P. H. & F. M. ROOTS, Manuf'rs, CONNERSVILLE, IND.
S. S. TOWNSEND, Gen'l Ag't, 31 Liberty St., NEW YORK.

TO WATER WORKS BUILDERS.
Bids are invited until the 25th of March next for the construction of Water Works for the city of Jacksonville, Florida, said water works to have a capacity of at least two millions of gallons per day, and one hundred fire hydrants required at beginning. To be owned and operated by the builder for an agreed term of years, with the privilege of purchase by the city at the end of that time, the city paying rent for all water for public use. Further information on application to the undersigned.
T. E. BUCKMAN,
Chairman Com. Water Supply.
JACKSONVILLE, FLA., Feb 16, 1877.

Revolvers 7-shot $2.50, 70 kinds. Guns & Rifles $5 to $500. Monster Ill. Cat. for 3-ct. stamp. WESTERN GUN WORKS, Chicago, Ill.

RUBBER* Boots* Etc* mended.*** 1/4lb.* Box* Cement* by* mail* 35c.** G. W. HOWE, Port Huron, Mich.

N. F. BURNHAM'S 1874 WATER WHEEL
Is declared the "**standard turbine,**" by **over 600** persons who bought and use them with **part** and **full gate** open. Pamphlets Free.
N. F. BURNHAM, York, Pa.

VANDERBURGH, WELLS & CO., MACHINISTS' Pattern and Brand Letters, etc., Complete Newspaper Outfits, Engravers' Boxwood, etc. 18 Dutch Street, cor. Fulton, New York.

N. Y. STENCIL WORKS, 87 Nassau St., N. Y.
Steel Name Stamps.

The Art of Projecting.

A Manual of Experimentation in Physics, Chemistry, and Natural History, with the Porte Lumiere and Magic Lantern. By Prof. E. A. DOLBEAR, Tufts College. With numerous illustrations. 12mo, cloth. $1.50.
Any one, whether teacher, lecturer, or student, who is the happy possessor of a Porte Lumiere, Magic Lantern, or other apparatus, will find this book of incalculable service in illustrating almost every department of natural science. The directions for making temporary apparatus are worth many times the price of the book.
For sale by booksellers, and mailed, prepaid, on receipt of price by the publishers,
LEE & SHEPARD, BOSTON.

Dayton Cam Pump.

THE ONLY PUMP IN THE MARKET DESIGNED AND CONSTRUCTED ESPECIALLY FOR BOILER FEEDING.
Are Pumping water at 208° F. No Dead Centers. The Steam Valve is a plain Slide Valve, identical to the slide valve of a Steam Engine, but derives its motion from a cam. Speed can be regulated to suit evaporation.
Pumping Returns from Steam Heating Apparatus a specialty.
Send for Circular.
Smith, Vaile & Co., DAYTON, OHIO.

UPRIGHT DRILL PRESSES,
H. BICKFORD, Cincinnati, Ohio.

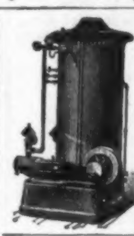
$5 TO $10 A DAY TO AGENTS. SAMPLES FREE. 32 page catalogue. L. FLETCHER, 11 Dey St., N. Y.

J. A. FAY & Co. CINCINNATI, OHIO. U.S.A.
WOOD WORKING MACHINERY,
Woodworth Planers and Matchers, Daniels & Dimension Planers, Universal Wood Workers, Band & Circular Re-Saws, Ripping, Edging & Cross-Cutting Saws, Moulding, Mortising and Tenoning Machines, Band & Scroll Saws, Carving, Boring, Shaping, Friezing & Sand Papering Machines, Wood Lathes & Machinery for Furniture, Car, Wheel & Agricultural Shops.
Superior to any in use. Prices reduced to suit the times.

Steel Castings,

From 1-4 to 10,000 lbs. weight. An invaluable substitute for expensive forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, EVELINA STREET, PHILADELPHIA, PA.

$500 will buy one, and $1,000 the other, of
Two British Patents
of special value to *Chair Makers* or parties producing *Cabinet Makers'* or *Builders' Hardware*. The articles patented in Great Britain are successfully introduced in this market under an American patent. But little capital is required in producing the articles ready for market, and they sell quickly at liberally remunerative price. Illustrated catalogues of the *American Goods* will be sent, and detailed information given, on application addressed to POST OFFICE BOX 2399, New York City.



NILES ENGINE
SUITABLE FOR
PRINTING OFFICES, HOTELS, LAUNDRIES, TANNERIES, SAUSAGE-MAKERS, etc.;
And for any purpose requiring an engine from 2 to 12 horse-power.
ADDRESS
NILES TOOL WORKS, Hamilton, Ohio.

NOW READY.
ILLUSTRATED HISTORY
OF THE
CENTENNIAL EXHIBITION OF 1876.

The full History and Progress of the Exhibition, Maps of the Grounds, Engravings of the Buildings, and accounts of all the most notable Scientific and Mechanical objects, profusely illustrated with engravings, are given in the **Scientific American Supplement** for the year 1876. This work consists of **Two Large Volumes**, comprising over 800 quarto pages, equal in quantity of reading matter to over Seven Thousand ordinary book pages. The space devoted to the great INTERNATIONAL EXHIBITION is very extensive, and probably forms the most complete and full history of the affair that can be obtained. The illustrations pertaining to the Exhibition are more than 450 in number. A copious Special Index of all matters relating to the Exhibition is given. Those who desire to possess a complete and splendid illustrated Record of the Centennial Exposition should have the SCIENTIFIC AMERICAN SUPPLEMENT for 1876.
In addition to this splendid History of the Centennial Exhibition, the SCIENTIFIC AMERICAN SUPPLEMENT for 1876 contains a vast amount of other matter of great value for reference and preservation. It presents to the reader, in attractive form, full accounts of the Advances made during the year in all the chief departments of Science and Useful Arts, covering the progress in Chemistry and Metallurgy, Mechanics and Engineering, Electricity, Light, Heat, Sound, Architecture, Photography, Technology, Pisciculture, Agriculture, Botany, Horticulture, Rural and Household Economy, Materia Medica, Hygiene, Natural History, Zoology, Microscopy, Meteorology, Terrestrial Physics, Geography, Geology, Mineralogy, Astronomy. The whole *illustrated by over Two Thousand Six Hundred Engravings.* The wide scope of this splendid work, its surprising variety of contents, its wealth of illustration, render it the most valuable contribution to scientific literature extant, while its price it is probably the most economical.
THE SCIENTIFIC AMERICAN SUPPLEMENT for 1876, complete, is supplied, stitched in paper covers, at the low price of $5. Strongly bound, both volumes in one book, cloth, ornamented with gilt, $6.50. Bound in two separate books, $4 each, or $8 for the two. Sold at the leading Bookstores and News Offices, and by
MUNN & CO., Publishers, 37 Park Row, New York.

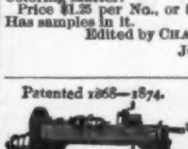
WANTED MEN to travel and sell to **Dealers** our unbreakable glass chimneys and lamp goods. **NO PEDDLING.** Salary liberal. Hotel and traveling expenses paid. MONITOR LAMP CO., 264 Main St., CINCINNATI, OHIO.

MOSELEY IRON BRIDGE & ROOF CO.
CORRUGATED IRON
Buildings, Roofs, Shutters, Doors, Iron Sashes, Skylights, etc.
5 Dey Street, New York.

FOR SALE.—THE WHOLE OR PART interest in Davie's Patent Cabinet Fire Escape, for Hotels, Public and Private Buildings. For further particulars, apply to JOHN DAVIE, Patentee, Box 718, Joliet, Will Co., Ill.

Dyers, Bleachers & Manufacturers of Textile Fabrics
The Textile Colorist,
A Monthly Journal long needed.
Treats especially of Printing, Bleaching, Dyeing, Finishing, and the manufacture and application of Coloring Matter.
Price $1.25 per No., or $12.00 per annum in advance. Has samples in it.
Edited by CHAS. O'NEILL, F. C. S.
JOHN WILEY & SONS,
15 Astor Place, N. Y. City.

Patented 1868—1874. **BOLT CUTTERS.**



Dies open and close and Bolt thrown out automatically.
One pattern, holds finished bolts on centres and threads them with greater accuracy and uniformity and ten times as fast as a chaser in a Lathe. Highest award of American Institute, 1869 & 1874.
Wood & Light Machine Co., Worcester, Mass. make all kinds of **Iron Working Machinery.** Also, **Shafting, Pulleys, &c.**

RUBBER
Belting, Packing, Hose, Clothing, Boots and Shoes, etc. Send for Price List. MACDONALD & SUTTON, 299 Broadway, New York.

EXCELLENT COPPER SOLUTION FOR SMALL IRON Castings. Neat, cheap, and a durable finish. No battery required. Address WM. H. WILLIAMS, So. Amboy, N. J.

FOR SALE CHEAP.—ONE LARGE Myers & Ennison Re-saw. Manufactured by Huntington Machine Co., Newark, N. J. Saw post 28 inches. HOUSE & DAVIDSON, 98 Scranton Av., Cleveland, O.

BLUE GLASS AND ITS WONDERS, with illustrations, by SAM C. UPHAM; just published. Mailed to any address for 10c. Trade supplied. S. C. UPHAM, 25 S. 8th St., Phila.

HOME TELEGRAPH INSTRUMENT, Battery, Book of Instruction. Complete and reliable outfit for *Learning Telegraphy*, and operating private Telegraph Lines. Price $5.50. Descriptive circulars mailed free. L. G. TILLOTSON & CO., 8 Dey St., N. Y.

$3 WATCHES. Cheapest in the known world. *Sample watch and outfit free to Agents.* For terms address COULTER & CO. Chicago

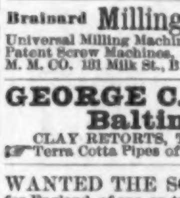
AIR COMPRESSORS
FOR ALL PURPOSES:
A SPECIALTY of HEAVY PRESSURES.
THE NORWALK IRON WORKS CO., SOUTH NORWALK, CONN.

Wood-Working Machinery,
Such as Woodworth Planing, Tongueing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

Brainard Milling Machines all styles and sizes.
Universal Milling Machines from $200 upwards. Brown's Patent Screw Machines, &c., &c. Address BRAINARD M. M. CO. 131 Milk St., Boston, Mass.

GEORGE C. HICKS & CO., Baltimore, Md.
CLAY RETORTS, TILES, FIRE BRICKS, &c.
Terra Cotta Pipes of all sizes.

WANTED THE SOLE MANUFACTURE, for England, of one or two Patent Articles in demand by steam users. Advertisers have good manufacturing premises, and a first-class connection among steam users in England and the Continent. Apply in first instance by letter to P. S. B., care of Mr. G. STREET, Advertising Offices, 30 Cornhill, London, E. C., England.



YOU ask WHY we can sell First-Class 7 1-3 Octave Rosewood Pianos for $290. Our answer is, that it costs less than $300 to make any $600 Piano sold through Agents, all of whom make 100 per ct. profit. We have no Agents, but sell DIRECT to Families, at Factory price, and warrant five years. We send our Pianos everywhere for trial, and require no payment unless they are found satisfactory. Send for our Illustrated Circular, which gives full particulars, and contains the names of over 1500 Bankers, Merchants and Families that are using our Pianos in every State of the Union. Please state where you saw this notice. Address,
U. S. PIANO CO., 810 Broadway, N. Y.

JUST PUBLISHED,
WOODWARD'S
Ornamental & Fancy Alphabets.
Three parts, fifty cents each, postpaid.
Order catalogue of new books on Art, Architecture and Agriculture.
Geo. E. Woodward, 136 Chambers Street, NEW YORK.

AYER & SON'S MANUAL For Advertisers
A complete guide to advertisers. *New Haven Journal.*—A necessity to all who advertise. *Louisville Commercial.*—The most complete and reliable work of the kind. *Pittsburg Gazette.*—**Sent free** to all who advertise.
N. W. AYER & SON Advertising AGENTS, TIMES BUILDING, PHILADELPHIA.
Get our Estimate before making any advertising contracts. Our business is large. Facilities unsurpassed. Prices the lowest. Terms the best.

$12 a day at home. Agents wanted. Outfit and terms free. TRUE & CO., Augusta, Maine.

Lathes, Planers, Shapers, Drills,
Gear & Bolt Cutters, &c. E. GOULD, Newark, N.J.

SEE PHOTOGRAPHIC APPARATUS & CHEMICALS complete, with directions, **$10.** No toy; takes pictures 4x5¼ inches. Send for illustrated circular.
B. MORGAN, 14 Ann St. New York, P. O. Box 4349.

$39 Each week to Agents, Goods Staple. 10,000 testimonials received. Terms liberal. Particulars free. J. Worth & Co. St. Louis, Mo.

$55 to $77 a week to Agents. $10 *Outfit Free.* P. O. VICKERY, Augusta, Maine.

CHLORIDE OF CALCIUM.
FOR SALE VERY CHEAP.
RANSOME, 10 Bush Street, San Francisco, Cal.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N. Y. who control the patent for Green's American Driven Well

VINEGAR. How made in 10 hours from Cider, Wine or Sorghum without using drugs. Name paper and address F. I. SAGE, Springfield Mass.

AGENTS. 64 page Illustrated Catalogue Free. Boston Novelty Co., Boston Mass.

The Toll-Gate! **Prize Picture** sent free! An ingenious gem! 50 objects to find! Address, with stamp, E. C. ABBEY, Buffalo, N.Y.

$984 Made by one Agent in 57 days. 13 new articles. Samples free. Address, **C. M. LININGTON, Chicago.**

TO INVENTORS AND MANUFACTURERS
FOLLOWS & BATE, Manchester, England, Hardware and Machinery Merchants, are prepared to buy American Goods for Cash, and to act as Sole Wholesale Agents.

WOODWORTH SURFACE PLANERS, $125. Planers and Matchers, $350. S. C. HILLS, 78 Chambers Street, New York.

Water Wheels.

More than four times as many of Jas. Leffel's improved Double Turbine Water Wheels in operation than any other kind. 24 sizes made, ranging from 5 3-4 to 96 in. diam. under heads from 1 to 240 ft. Successful for every purpose. Large new pamphlet, the finest ever published, containing over 30 fine illustrations, sent free to parties interested in water power.
JAS. LEFFEL & CO., Springfield, O., and 109 Liberty St., New York City.

Pocket Coin Detector
Size of a Silver Dollar. With it and a pen-knife you can test any coin accurately. Price 25 cents by mail. Liberal discounts to Agents.
J. W. SUTTON,
95 Liberty Street, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Prospectus

OF THE

SCIENTIFIC AMERICAN

For 1877,

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTY-SECOND YEAR.

VOLUME XXXVI.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the sixth day of January, 1877, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

TERMS OF SUBSCRIPTION.

One copy of the SCIENTIFIC AMERICAN will be sent for *one year,* 52 numbers, POSTAGE PREPAID, to any subscriber in the United States or Canada, on receipt of *three dollars and twenty cents* by the publishers.

One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; or six copies for $16.50 without extra copy. Postage free.

The Scientific American Supplement.

A weekly paper, uniform in size with the SCIENTIFIC AMERICAN, but a distinct publication. It contains working drawings of engineering works, and elaborate treatises on every branch of Science and Mechanics, by eminent writers, at home and abroad. An illustrated cover protects the handsomely printed sheets. Price, $5.00 per annum. Single copies 10 cents.

One copy of the SCIENTIFIC AMERICAN *and one copy of the* SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven Dollars* by the publishers.

The safest way to remit is by Postal-Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and carefully addressed, seldom goes astray; but it is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.